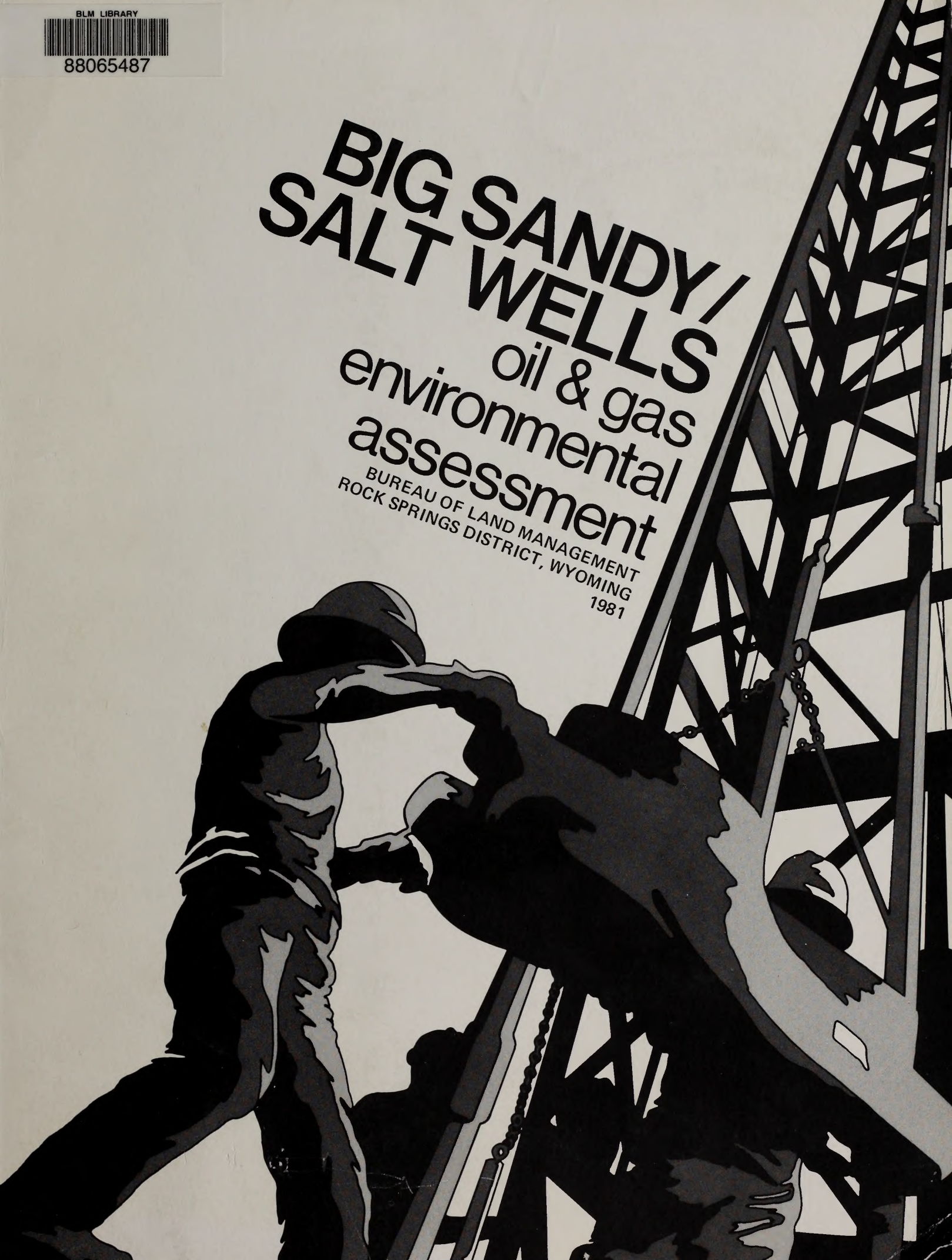
BIG SANDY/ SALT WELLS

oil & gas environmental assessment

BUREAU OF LAND MANAGEMENT
ROCK SPRINGS DISTRICT, WYOMING

1981



United States Department of the Interior

IN REPLY REFER TO
1792 (420)

BUREAU OF LAND MANAGEMENT
District Office
P.O. Box 1869
Rock Springs, Wyoming 82901

December 15, 1981

Dear Reader:

Enclosed is a draft regional environmental assessment on oil and gas development in the Big Sandy and Salt Wells resource areas. The area analyzed includes nearly five million acres of federal, state, and private land in Sweetwater, Fremont, Sublette, Lincoln, and Uinta counties, Wyoming. This EA was prepared to (1) analyze the environmental impacts of oil and gas development in this area over the next ten years; (2) to review existing practices; and (3) to develop additional measures to mitigate those impacts where indicated. This EA is an integral part of the Bureau's land use planning process. Earlier this year, tentative land use decisions were made for all resources. This EA analyzes those land use decisions relating to oil and gas leasing.

I would encourage you to retain this document. If major revisions are not necessary, this draft EA will form Volume 1 of the final environmental assessment. Any additions or changes will be included in a final supplemental EA.

Written comments on this draft will be accepted through January 20, 1982, by the Team Leader, Bureau of Land Management, Rock Springs District Office, P.O. Box 1869, Rock Springs, Wyoming, 82901. Your participation is appreciated.

Sincerely yours,

Donald K. Simp

District Manager

DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

DRAFT ENVIRONMENTAL ASSESSMENT OF OIL AND GAS DEVELOPMENT IN BIG SANDY/SALT WELLS RESOURCE AREAS ROCK SPRINGS DISTRICT, WYOMING

WY-049-EA81-1

Located in the Counties of Sweetwater, Fremont, Sublette, Lincoln, and Uinta.

DECEMBER 1981

DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

DRAFT ENVIRONMENTAL ASSESSMENT
OF
OIL AND GAS DEVELOPMENT
IN
BIG SANDY/SALT WELLS RESOURCE AREAS
ROCK SPRINGS DISTRICT, WYOMING

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Located in the Counties of Sweetwater, Fremont,
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DECEMBER 1981

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CHAPTER I

BACKGROUND AND MANAGEMENT ALTERNATIVES

INTRODUCTION

The National Environmental Policy Act (NEPA) and subsequent laws, regulations, and policies require that all programs and activities conducted or authorized by the Bureau of Land Management (BLM) be reviewed to determine their probable environmental impacts. The nature and scope of the action determine the type of review to be made.

One of the major BLM program activities in Wyoming and the Rock Springs District is the leasing of the federally owned mineral estate to private individuals and organizations for the production of oil and gas. The development of these leases and the associated activities affect the quality of the environment and must be assessed.

This environmental assessment (EA) describes the present and probable future impacts of oil and gas exploration, development, and production in the Big Sandy and Salt Wells Resource Areas (Map I-1) through 1991. This EA is an integral part of the land use planning process. Land use plans (Management Framework Plan-MFP) are being developed for the assessment area. Earlier this year, tentative land use decisions were made for all resources. This EA will analyze those tentative land use decisions relating to oil and gas leasing. The results of the analysis will be considered in making the final land use decisions. The EA will provide guidance to BLM managers in formulating responsible decisions regarding the resources they manage. Among other things, it focuses on those areas identified in the MFP as unsuitable for leasing or suitable only with special provisions or stipulations.

PURPOSE OF THE PROPOSAL

The purpose of the proposal is to provide for orderly and responsible development of the federally owned oil and gas within the area in order to meet national energy needs.

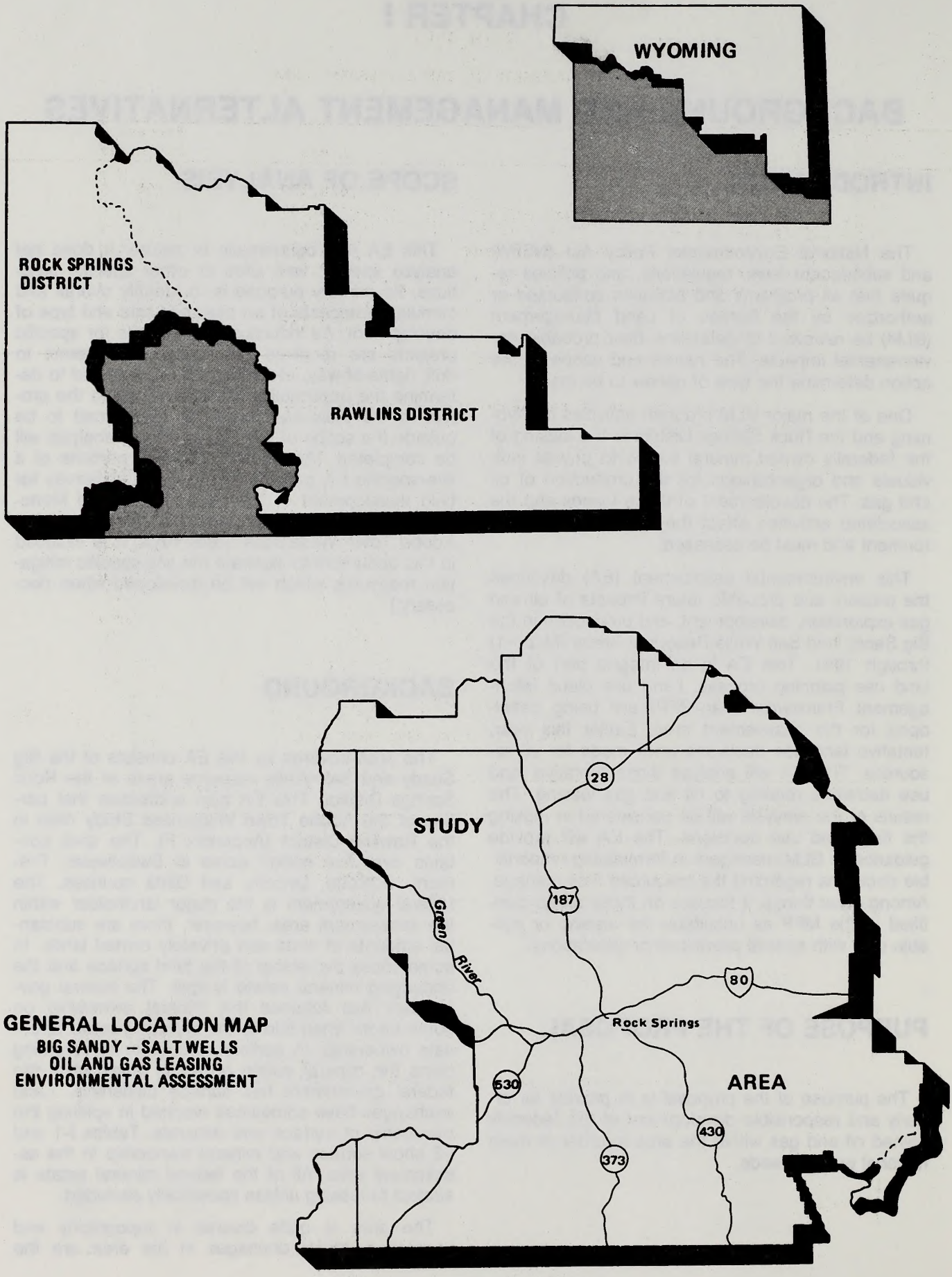
SCOPE OF ANALYSIS

This EA is programmatic in nature. It does not analyze specific well sites or other specific practices. Its primary purpose is to identify overall and cumulative impacts of an assumed rate and type of development. As individual applications for specific projects are received (applications for permit to drill, rights-of-way, etc.) they will be reviewed to determine the applicability of this analysis to the project. If the individual project is determined to be outside the scope of this EA, additional analysis will be completed. (Appendix F contains portions of a site-specific EA prepared by Geological Survey for field development of the Adobe Town and Monument Valley units which included portions of the Adobe Town Wilderness Study Area. It is included in this document to illustrate the site-specific mitigation measures which will be developed when necessary.)

BACKGROUND

The area covered by this EA consists of the Big Sandy and Salt Wells resource areas of the Rock Springs District. This EA also addresses that portion of the Adobe Town Wilderness Study Area in the Rawlins District (Appendix F). The area contains over five million acres in Sweetwater, Fremont, Sublette, Lincoln, and Uinta counties. The federal government is the major landholder within the assessment area; however, there are substantial amounts of state and privately owned lands. In some cases ownership of the land surface and the underlying mineral estate is split. The federal government has retained the mineral ownership on some tracts when title to the surface passed to private ownership. In addition, the State of Wyoming owns the mineral estate on some lands while the federal government has surface ownership. Land exchanges have sometimes resulted in splitting the ownership of surface and minerals. Tables I-1 and I-2 show surface and mineral ownership in the assessment area. All of the federal mineral estate is subject to leasing unless specifically excluded.

The area is quite diverse in topography and vegetation. Major drainages in the area are the



GENERAL LOCATION MAP
BIG SANDY – SALT WELLS
OIL AND GAS LEASING
ENVIRONMENTAL ASSESSMENT

Table I-1

SURFACE OWNERSHIP IN THE ASSESSMENT AREA

Surface Estate	Acres	Percent Of Total
BLM[1/]	3,628,379	68
U.S. Fish and Wildlife Service	16,886	[2/]
U.S. Forest Service	58,923	1
Flaming Gorge National Recreation Area	27,834	0.5
Other Federal	209,924	4
State of Wyoming	184,267	3
Private	1,201,192	23.5
Total	5,327,405	100.0

[1/] Includes that portion of the Adobe Town Wilderness Study Area in the Rawlins District.

[2/] Less than 1%

Table I-2

MINERAL OWNERSHIP IN THE ASSESSMENT AREA

Mineral Estate	Acres	Percent Of Total
Federal Surface/Federal Minerals	3,774,701[1/]	71
Private Surface/Federal Minerals	81,485	1
Subtotal Federal Minerals	3,856,186	72
Private Surface/Private Minerals	1,303,974	25
Federal Surface/Private Minerals	167,245[2/]	3
Subtotal Private Minerals	1,471,219	28
TOTAL	5,327,405	

Note: Private includes State of Wyoming.

[1/] Includes Flaming Gorge National Recreation Area and that portion of the Adobe Town Wilderness Study Area in the BLM Rawlins District.

[2/] Includes that portion of the Adobe Town Wilderness Study Area in the Rawlins District.

Green and Sweetwater rivers. While the area has been perceived as primarily a ranching area, it is characterized by a high degree of economic diversity. The Union Pacific Railroad's east-west mainline and Interstate 80 traverse the area, and the mineral and transportation industries have been important for a long time.

Oil and gas development began within the area in the early 1920's. The level of oil and gas activity has expanded with changes in market conditions and technological advances.

The largest communities within the assessment area are Rock Springs (population 19,454; 1980 Census of Population and Housing) and Green River (population 12,807; 1980 Census). Several other nearby communities (most notably Evanston) are economically entwined with the assessment area. Total population of the area is estimated to be 40,000.

Oil and Gas Development and Production

Commercial production of hydrocarbons first began in the area in the 1920's in Baxter Basin and at Hiawatha. Both of these fields continue to produce natural gas in substantial quantities. Oil and gas activities were minimal until the late 1950's and early 1960's when new technology and demand resulted in a period of increased drilling activity. Between 1964 and 1974, drilling activity continued at a relatively moderate and fairly consistent level. In 1975 a steady increase in drilling activity began. Rapid improvements in drilling technology and hydrocarbon price increases have contributed to an increase in the number of wells drilled. Recently, several test wells have been drilled in excess of 20,000 feet. Sweetwater County was second in the state in the number of drilling permits issued in 1979, with 226.

The assessment area comprises a major portion of the Green River Basin which is a significant source of hydrocarbons in Wyoming and nationally. Map II-1 (inside back cover) illustrates the producing fields in the assessment area. In 1978 Barlow and Haun estimated that the Green River Basin had produced 40.6% of the gas and 9.4% of the oil to date in Wyoming and that it contained 60.4% of the remaining gas reserves and 33.2% of the remaining oil reserves in the state. It is probable that these estimates would be somewhat lower today, due to recent discoveries in the Overthrust Belt and expanded estimates of the reserves located there. This does not, however, diminish the actual importance of the hydrocarbon resource within the assessment area. Tables I-3 through I-6 list the producing fields and operating facilities within the assessment area.

DESCRIPTION OF ALTERNATIVES INCLUDING THE PROPOSED ACTION

Oil and gas development is a long and involved process. The time lapse between exploration and abandonment is typically 30 years or more and there are many steps and controlling factors in between. In addition to BLM, state and other federal agencies exert control over the process (see Chapter I, Authorizing Actions). The decision to lease and the conditions under which leases will be issued are the most discretionary and far reaching in terms of the probability and predictability of causing adverse impacts. Therefore, BLM's greatest opportunity to influence impacts occurs prior to leasing.

Once an oil and gas lease is issued, the following corollary activities may occur: (1) geophysical exploration (this activity can and often does occur prior to leasing); (2) drilling of oil and gas wells; (3) construction of access roads and any necessary support facilities; and (4) the production and processing of hydrocarbons and byproducts.

Present Bureau policy toward oil and gas leasing is based on both law and Bureau instruction. Subpart 3101.1 of 43 *Code of Federal Regulations* (CFR) states that all lands subject to disposition under the act (the Mineral Leasing Act of 1920) which are known or believed to contain oil or gas may be leased by the Secretary of the Interior, except for lands within national parks, Indian reservations, or incorporated cities. In addition, the Secretary may withdraw lands from leasing. The withdrawal of land from oil and gas leasing (or any other use) is a public process subject to protest and appeal. Leasing, therefore, is a discretionary action. However, Bureau policy, as described in the BLM Manual 3000, is "to encourage the orderly development of the mineral resources under its jurisdiction," where such development is consistent with multiple-use management and environmental considerations. Furthermore, the Wyoming State Office Supplement to BLM Manual 3109 states that "objection to leasing all or part of lands within a lease application is valid only when the impacts of oil and gas exploration or development cannot be satisfactorily mitigated, and the surface or environmental values are judged to be greater than the potential oil and gas resource."

Table I-3

WYOMING OIL AND GAS FIELDS AND UNITS
PRODUCTION 1979

Field or Unit Name	County	First Discovered	Location Twp. Rg.	No. Producing Wells	Dec. 1979 Production Oil-bbls. Gas-mcf	1979 Annual Production Oil-bbls. Gas-mcf	Cumulative Production Oil-bbls. Gas-mcf	Remarks[1/]
Airport	Sweetwater	1972	19N-103W	2	0	0	0	Oil
					3,830	42,947	781,291	Gas
Alkaline Creek	Sweetwater	1977	16N-98W	1	0	1,380	1,805	Oil
					0	17,359	127,088	Gas
Antelope	Sweetwater	1970	17N-99W	10	26	444	23,826	Oil
					151,914	1,587,010	20,444,058	Gas
Arch	Sweetwater	1959	19N-98W	23	10,915	157,880	17,672,724	Oil
					110,951	795,087	78,827,795	Gas
Bartlett	Sweetwater	1973	19N-102W	1	0	0	0	Oil
					0	20,649	1,071,450	Gas
Baxter Basin, Middle	Sweetwater	1938	18N-103W	5	0	0	0	Oil
					52,845	420,856	17,406,908	Gas
Baxter Basin, N	Sweetwater	1926	20N-103W	18	0	0	48,001	Oil
			19,20N-104W		130,924	951,458	76,165,161	Gas
Baxter Basin, S	Sweetwater	1922	16N-104W	17	0	0	0	Oil
					133,957	1,048,494	152,412,052	Gas
Bird Canyon	Sublette	1971	27N-112W	11	129	885	9,014	Oil
					113,406	725,261	3,533,084	Gas
Bitter Creek	Sweetwater	1962	16N-99W	1	0	0	0	Oil
					1,520	46,776	128,181	Gas
Black Butte Creek	Sweetwater	1959	19N-102W	1	0	0	0	Oil
					0	0	761,959	Gas
Brady	Sweetwater	1973	16N-101W	19	331,694	4,279,649	24,695,445	Oil
					1,546,319	18,231,194	88,259,278	Gas
Buckhorn	Sweetwater	1979	25N-111W	1	0	0	0	Oil
					0	0	0	Gas
Bush Lake	Sweetwater	1978	24N-96W	4	0	20	2,331	Oil
					69,897	172,334	192,166	Gas

Table I-3
(continued)

WYOMING OIL AND GAS FIELDS AND UNITS
PRODUCTION 1979

Field or Unit Name	County	First Discovered	Location Twp. Rg.	No. Producing Wells	Dec. 1979 Production Oil-bbls. Gas-mcf	1979 Annual Production Oil-bbls. Gas-mcf	Cumulative Production Oil-bbls. Gas-mcf	Remarks[1/]
Buster Basin	Sweetwater	1974	12N-107W	1	0	0	1,378	Oil-SI
					0	0	3,622	Gas
Butcher Knife Springs	Uinta	1971	15N-112W	1	2,667	9,155	21,808	Oil
					171,865	577,777	602,829	Gas
Camel Rock	Sweetwater	1979	18N-102W	1	0	1,840	1,840	Oil
					0	1,652	1,652	Gas
Canyon Creek	Sweetwater	1941	12,13N-100, 101W	35	3,656	35,205	1,036,508	Oil
					898,492	8,670,709	197,223,302	Gas
Chimney Rock	Sweetwater	1956	18N-102W	0	0	0	0	Oil-Abd.
					0	0	0	Gas-1974
Church Buttes	Sweetwater & Uinta	1956	16N-112,113W-17N-112W	18	475	5,310	46,675	Oil
					878,202	8,155,622	290,722,464	Gas
Crooked Canyon	Sweetwater	1976	21N-103W	11	0	8	146	Oil
					0	12,581	105,857	Gas
Deadman Wash	Sweetwater	1973	20N-101W	3	0	0	4,093	Oil
					96,931	1,580,359	16,430,729	Gas
Desert Springs	Sweetwater	1958	20,21N-97,98W	9	269	2,850	1,118,807	Oil
					154,605	1,134,984	165,770,629	Gas
Desert Springs, E	Sweetwater	1965	21N-97W	1	509	4,389	666,330	Oil
					102,455	739,497	11,654,091	Gas
Desert Springs, W	Sweetwater	1959	19,20N-99W	44	8,440	93,501	914,869	Oil
					1,526,750	15,039,623	31,443,260	Gas
East LaBarge	Lincoln & Sublette	1957	26,27N-112W	21	387	11,509	444,764	Oil
					180,501	1,684,043	36,519,966	Gas
Figure Four Canyon	Sublette	1959	27N-112W	2	0	0	0	Oil
					6,525	71,066	2,743,959	Gas
Forbes	Sweetwater	1979	25N-97W	1	0	0	0	Oil
					0	0	0	Gas

Table I-3
(continued)

WYOMING OIL AND GAS FIELDS AND UNITS
PRODUCTION 1979

Field or Unit Name	County	First Discovered	Location Twp. Rg.	No. Producing Wells	Dec. 1979 Production Oil-bbls. Gas-mcf	1979 Annual Production Oil-bbls. Gas-mcf	Cumulative Production Oil-bbls. Gas-mcf	Remarks[1/]
Golden Wall	Sweetwater	1977	18N-101W	1	0	0	90	Oil
					0	0	0	Gas
Green River Bluffs	Sublette	1959	27N-110W	0	0	0	0	Oil-SI
					0	0	0	Gas-1959
Hallville	Sweetwater	1962	19N-100W	1	0	468	30,391	Oil
					0	0	2,737	Gas
Hansen Draw	Sweetwater	1977	17N-96W	1	0	0	0	Oil
					1,679	3,757	8,368	Gas
Hiawatha	Sweetwater	1928	12N-99W	18	315	10,182	62,036	Oil
					298,617	1,761,990	68,013,963	Gas
Higgins	Sweetwater	1969	17N-99W	11	206	3,241	7,302	Oil
					1,319,977	14,190,685	24,562,687	Gas
Horn Canyon Unit	Sweetwater	1976	24N-100W	1	0	0	8	Oil
					0	0	9,000	Gas-SI
Iron Pipe	Sweetwater	1978	16N-98W	1	0	0	0	Oil
					0	0	0	Gas-SI
Joyce Creek	Sweetwater	1958	15N-103W	9	657	7,733	170,230	Oil
					17,097	280,375	10,323,625	Gas
Kinney	Sweetwater	1959	13N-99W	7	0	180	18,140	Oil
					370,138	1,264,287	20,139,402	Gas
Laney Wash	Sweetwater	1979	17N-97W	1	0	0	0	Oil-SI
					0	0	0	Gas
Leo	Sweetwater	1975	15N-11W	1	0	436	2,755	Oil
					0	0	12,453	Gas-P&A
Leucite Hills	Sweetwater	1969	22N-103W	3	0	0	0	Oil
					16,526	109,286	1,982,473	Gas

Table I-3
(continued)

WYOMING OIL AND GAS FIELDS AND UNITS
PRODUCTION 1979

Field or Unit Name	County	First Discovered	Location Twp. Rg.	No. Producing Wells	Dec. 1979 Production Oil-bbls. Gas-mcf	1979 Annual Production Oil-bbls. Gas-mcf	Cumulative Production Oil-bbls. Gas-mcf	Remarks[1/]
Lincoln Road	Sweetwater	1977	24N-111W	3	128	1,745	5,916	Oil
					91,703	1,128,779	2,804,890	Gas
Little Worm Creek	Sweetwater	1957	15N-104W	0	0	0	9,987	Oil
					0	0	3,357,584	Gas
Lost Creek	Sweetwater	1972	23N-97W	2	0	0	375	Oil-Abd.
					0	47	29,301	Gas-1978
Marianne	Sweetwater	1979	20N-103W	1	0	0	0	Oil
					0	0	0	Gas
Massacre Hills	Sweetwater	1962	16,17N-107, 108,109W	0	0	0	759	Oil-Abd.
					0	0	0	Gas-1963
Masterson	Sweetwater	1970	20N-102W	2	0	0	1,627	Oil
					8,107	92,317	744,409	Gas
Megas	Sweetwater	1979	22N-106W	1	0	0	0	Oil-SI
					0	0	0	Gas
Middle Mountain	Sweetwater	1952	12N-103W	1	0	0	56,052	Oil-Abd.
					0	0	8,857,777	Gas-1977
Monell	Sweetwater	1964	18,19N-99W	49	40,860	503,121	36,687,196	Oil
					14,423	237,412	115,454,757	Gas
Mud Lake	Sweetwater	1959	23N-98W	0	0	0	0	Oil-Abd.
					0	0	0	Gas-1960
Neff	Sweetwater	1968	18N-98W	0	0	0	255	Oil-SI
					0	0	32,795	Gas-1970
Patrick Draw	Sweetwater	1959	18N-99,100W	36	8,289	107,046	1,978,492	Oil
					55,164	930,452	10,478,344	Gas
Picket Lake	Sweetwater	1978	26N-97W	2	0	3,729	4,593	Oil
					0	0	0	Gas
Pine Canyon	Sweetwater	1964	23N-103W	7	92	1,338	18,207	Oil
					178,107	1,021,437	8,533,232	Gas

Table I-3
(continued)

WYOMING OIL AND GAS FIELDS AND UNITS
PRODUCTION 1979

Field or Unit Name	County	First Discovered	Location Twp. Rg.	No. Producing Wells	Dec. 1979 Production Oil-bbls. Gas-mcf	1979 Annual Production Oil-bbls. Gas-mcf	Cumulative Production Oil-bbls. Gas-mcf	Remarks[1/]
Playa	Sweetwater	1958	20,21N-98,99W	17	983	12,795	399,051	Oil
					308,890	3,157,193	35,550,476	Gas
Point of Rocks	Sweetwater	1963	20N-101W	1	3,405	32,390	40,471	Oil
					20,301	171,616	1,687,105	Gas
Potter Mountain	Sweetwater	1956	14N-103W	2	0	0	10	Oil
					4,181	60,225	166,347	Gas
Pretty Water Creek	Sweetwater	1962	15N-104W	1	0	92	276	Oil-Reactivated
					0	10,302	839,374	Gas-1979
Red Hill	Sweetwater	1962	19N-100W	0	0	0	0	Oil
					0	0	14,913	Gas-SI
Reiser Canyon	Sweetwater	1979	19N-106W	0	0	0	0	Oil
					0	0	0	Gas
Robin	Sweetwater	1971	19N-97W	3	268	15,068	146,232	Oil
					9,337	113,191	375,547	Gas
Roser	Sweetwater	1971	21N-100W	0	0	0	0	Oil-SI
					0	0	0	Gas
Salazar	Sweetwater	1975	16N-95W	2	6	50	50	Oil
					9,026	29,247	159,519	Gas
Salt Wells	Sweetwater	1949	14N-103W	2	0	13	316,578	Oil
					40,863	487,169	12,841,478	Gas
Sand Butte	Sweetwater	1960	17N-99W	1	0	0	0	Oil
					11,468	60,559	1,812,043	Gas
Sheep Camp	Sweetwater	1976	22N-97W	4	64	5,937	7,658	Oil
					11,726	97,694	120,033	Gas
Shiprock	Sweetwater	1979	20N-101W	2	0	0	0	Oil
					29,951	125,588	125,588	Gas

Table I-3
(continued)

WYOMING OIL AND GAS FIELDS AND UNITS
PRODUCTION 1979

Field or Unit Name	County	First Discovered	Location Twp. Rg.	No. Producing Wells	Dec. 1979 Production Oil-bbls. Gas-mcf	1979 Annual Production Oil-bbls. Gas-mcf	Cumulative Production Oil-bbls. Gas-mcf	Remarks[1/]
Smokey	Sweetwater	1979	15N-99W	1	0	0	0	Oil
					0	0	0	Gas
Stage Stop	Sweetwater	1966	18N-99W	11	1,864	22,133	535,490	Oil
					45,278	350,790	7,380,771	Gas
Stead Canyon	Lincoln	1964	26N-112W	3	7	523	128,974	Oil
					10,908	132,434	286,106	Gas
Storm Shelter	Sweetwater	1975	23N-111W	14	6,761	22,673	65,752	Oil
					153,888	995,329	2,415,194	Gas
Swan	Sweetwater	1970	25N-110W	3	602	8,430	8,430	Oil
					65,591	646,366	646,366	Gas
Table Rock	Sweetwater	1946	18,19N-97,98W	35	4,449	71,664	1,830,325	Oil
					6,639,186	35,488,049	227,062,857	Gas
Table Rock, S	Sweetwater	1955	18N-98W	2	845	10,398	73,047	Oil
					14,607	151,043	4,968,744	Gas
Table Rock, SW	Sweetwater	1955	18N-98W	1	0	0	0	Oil
					7,819	74,236	1,168,006	Gas
Ten Mile Draw	Sweetwater	1962	21N-98,99W	5	0	10	3,915	Oil
					56,692	200,499	4,990,172	Gas
Trail	Sweetwater	1958	13,14N-100W	5	1,295	6,934	281,796	Oil
					250,226	1,552,686	50,133,606	Gas
Twin Rocks	Sweetwater	1956	21N-103W	0	0	0	139	Oil-TA
					0	0	92,151	Gas
Vermillion Creek	Sweetwater	1961	13N-100,101W	0	0	0	453	Oil-Abd.
					0	0	24,204	Gas-1963
Wells Bluff	Sweetwater	1979	18N-96W	1	0	0	0	Oil
					5,393	10,775	64,230	Gas

Table I-3
(continued)

WYOMING OIL AND GAS FIELDS AND UNITS
PRODUCTION 1979

Field or Unit Name	County	First Discovered	Location Twp. Rg.	No. Producing Wells	Dec. 1979 Production Oil-bbls. Gas-mcf	1979 Annual Production Oil-bbls. Gas-mcf	Cumulative Production Oil-bbls. Gas-mcf	Remarks[1]
White Feather	Sweetwater	1972	21N-110W	0	0 0	0 0	2,755 0	Oil-Abd. Gas
				TOTAL OIL	430,263	5,452,354	89,606,177	
				TOTAL GAS	16,398,758	126,663,153	1,821,605,458	

[1] SI = Shut In (oil or gas found but not currently being produced).
Abd. = Unit abandoned.
P&A = Plugged and abandoned.
TA = Temporarily abandoned.

Source: Wyoming Oil and Gas Statistics 1979; compiled by the Wyoming Oil and Gas Commission; Casper, Wyoming.

Table I-4

SECONDARY RECOVERY FIELDS
WATER INJECTION PROJECTS

Field or Unit	County	Lease or Unit	Source of Injection	Injected Formation	Injectors Active (Inactive)	Year	Operator
Arch Unit	Sweetwater	Arch Unit	Purchased Water	Almond	45 (5)	1964	Champlin Petroleum Co.
Patrick Draw	Sweetwater	Monell	Fox Hills	Almond	77 (1)	1963	El Paso Products

Source: Wyoming Oil and Gas Statistics 1979; compiled by the Wyoming Oil and Gas Commission; Casper, Wyoming.

Table I-5

WATER DISPOSAL SYSTEMS

Field or Unit	County	Lease or Unit	Injected Formation	Type	No. of Disposal Wells	Year	Operator
Brady	Sweetwater	Brady Unit	Lower Ericson & Upper Rock Springs	Salt Water	1	1975	Champlin Petroleum
Table Rock	Sweetwater	Table Rock Unit	Ericson	Salt Water	1 (not yet operating)		Texaco, Inc.

Source: Wyoming Oil and Gas Statistics 1979; compiled by the Wyoming Oil and Gas Commission; Casper, Wyoming.

DM, Casper

United States Department of the Interior

BUREAU OF LAND MANAGEMENT
WYOMING STATE OFFICE
P.O. BOX 1828
CHEYENNE, WYOMING 82003

MAY 31 3 22 PM '90
PLATTE RIVER RESOURCE AREA

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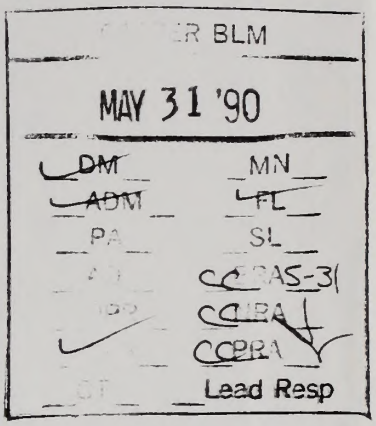
May 30, 1990



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Information Bulletin No. WY-90- 202

To: District Managers, DSDs Minerals and L&RR

From: Associate State Director

Subject: Colorado Oil and Gas Leasing DEIS **DD 8/14/90**

Attached is a copy of the Colorado Oil and Gas Leasing Draft EIS for your information and use. The intent of the DEIS is to amend RMP\EISs for five Resource Areas throughout the State in order to bring them into compliance with the SPG requirements. The DEIS also analyzes coalbed methane (CBM) development in three areas: Glenwood Springs RA, Little Snake RA, and San Juan/San Miguel Planning Area.

The Colorado approach to 3101.1-2, Surface Use Rights, is addressed on page 2-4. Colorado Conditions of Approval for APDs (COAs) are listed in Appendix D and F.

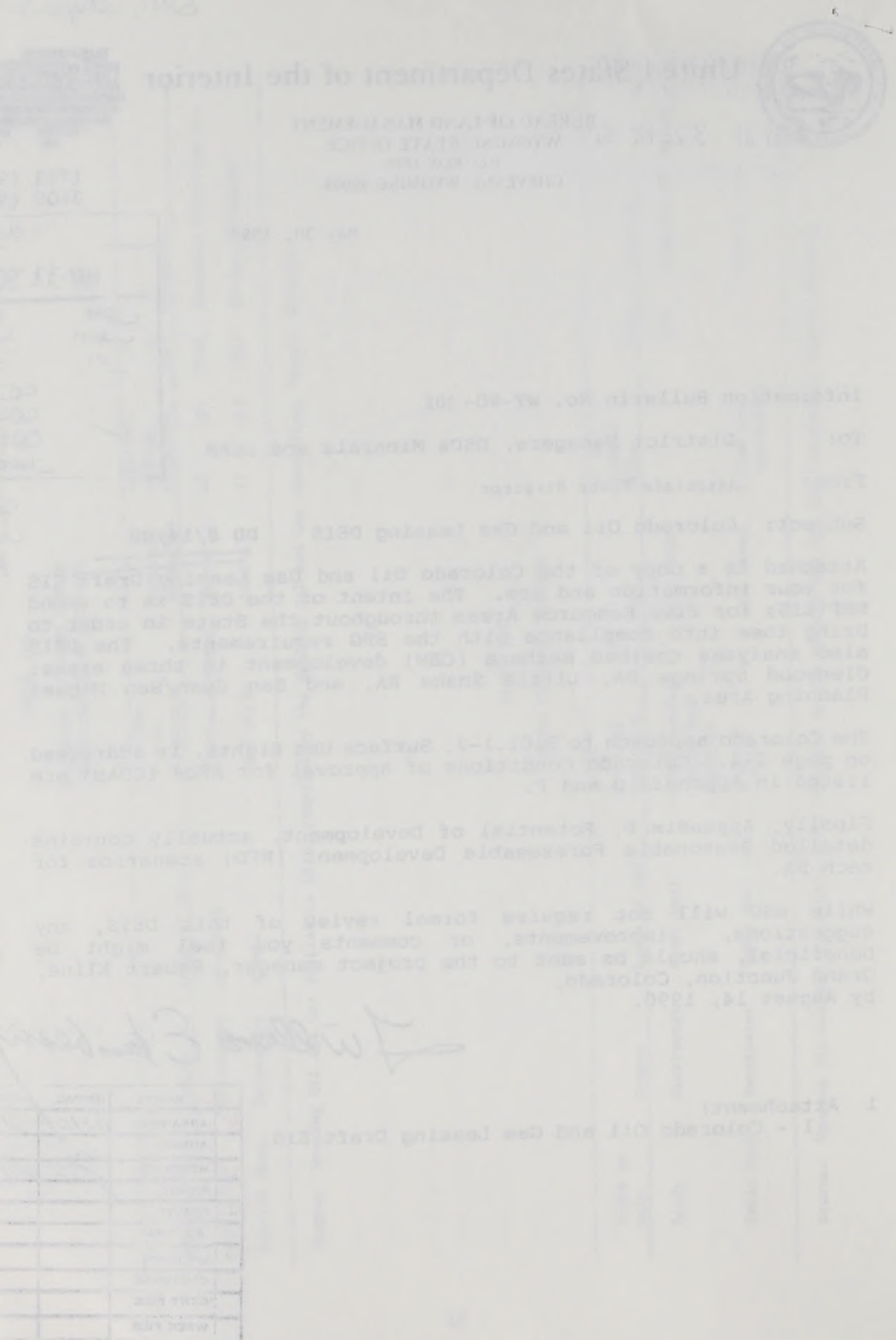
Finally, Appendix B, Potential of Development, actually contains detailed Reasonable Foreseeable Development (RFD) scenarios for each RA.

While WSO will not require formal review of this DEIS, any suggestions, improvements, or comments you feel might be beneficial, should be sent to the project manager, Robert Kline, Grand Junction, Colorado,
by August 14, 1990.

J William Eisenberg

1 Attachment:
1 - Colorado Oil and Gas Leasing Draft EIS

ROUTE	INITIAL	DATE
AREA MGR.	W Hoh	6/1
ADMIN.		
MINERALS		6/4
RANGE		
REALTY		
REC FOREST		
WILDLIFE		
CULTURAL		
CENT FILE		
WEEK FILE		



Distribution

Director (620), Rm 602, Premier Bldg.	1 w/o atch.
SCD (SC-325)	1 w/o atch.
EEO	1 w/o atch.
CF	2 w/o atch.
RA	1 w/atch.

United States Department of the Interior
Bureau of Land Management

Colorado State Office

April 1990

COLORADO OIL AND GAS LEASING

DRAFT ENVIRONMENTAL IMPACT STATEMENT

Table I-6

OPERATING GAS PLANTS

Plant or Field Area	County	Plant Operator	Date of First Report	Gas Intake for 1979 MCF	Annual Production Gallons Hydrocarbons, Propane-Butane-Gasoline	Tons Sulfur
Brady	Sweetwater	Champlin Petroleum Company P.O. Box 552, Enid, OK 73701	November 1975	15,880,708	25,757,017	None
Church Buttes	Sweetwater	Mountain Fuel Supply Company P.O. Box 11368 Salt Lake City, UT 84111	February 1963	7,983,541	2,044,110	None
Patrick Draw	Sweetwater	Champlin Petroleum Company P.O. Box 552, Enid, OK 73701	October 1961	5,116,718	18,744,924	None
Patrick Draw	Sweetwater	Gas Producing Enterprises, Inc. P.O. Box 749 Denver, CO 80201	June 1961	914,637	1,257,928	None
Table Rock	Sweetwater	Colorado Interstate Gas Co. P.O. Box 1087 Colorado Springs, CO 80944	March 1978	16,829,595	1,634,459	22,568

Source: Wyoming Oil and Gas Statistics 1979; compiled by the Wyoming Oil and Gas Commission; Casper, Wyoming.

The proposed action and alternatives considered in developing this EA represent levels of environmental protection ranging from few restrictions on development of leases to the opposite extreme; protection criteria so stringent that little development could occur. Table I-7 compares the proposed action and the alternatives. Regardless of the number of environmental protection criteria applied to leasing; the actual leasing process, the permitting of corollary activities, and the development of oil and gas resources remain the same. Therefore, these actions are a part of the proposed action and each alternative. However, because these actions are many and complex, their description has been placed in a separate section of this environmental assessment (see Oil and Gas Development and Operating Procedures, Appendix A).

Implementation of the proposed action or alternatives would be immediate for those lands currently leased as the leases are renewed. Leases in production prior to expiration cannot be terminated upon expiration. The application of new stipulations to existing leases involves coordination and often compromise with lessees and GS.

Proposed Action

BLM has established, through its land use planning system, certain criteria for environmental protection in the assessment area. The criteria and the rationale for their use are described in the Management Framework Plan (MFP) for the resource areas involved. BLM's proposed action is to continue issuing leases, subject to the limitations imposed by the MFP (currently being updated), as well as by law. Under the proposed action, leasing would not be allowed on 5,280 acres; 100,462 acres would be leased with no surface occupancy allowed. The remaining area (98 percent) would be open to oil and gas leasing and subsequent development. Standard stipulations (e.g., "Existing roads and trails shall be used whenever possible.") would be applied to the open area and, in environmentally sensitive situations (e.g., elk calving grounds), special stipulations would be applied. See Chapter III, Mitigating Measures and Appendices C and D for detailed information on stipulations.

Law

Legal restrictions on leasing relevant to the area are (1) no leasing within incorporated city limits and (2) special conditions for leasing in wilderness study areas. There are three incorporated cities or towns within the area: Rock Springs, Green River, and Superior. There are 14 Wilderness Study Areas (WSAs) in the assessment area which have been identified for intensive study and subsequent suitability reports (see Chapter II, Wilderness). BLM can issue leases and authorize development in these areas but special provisions apply (see Appendix C, Figure C-1).

Management Framework Plan

Proposed MFP decisions relating to oil and gas leasing are summarized in Table I-8. Most decisions are common to both resource areas; those that apply to only one resource area are noted in the table. These items are restrictions or stipulations that apply to the lease in general and should be known to the interested lessee to facilitate general unit development plans. Site-specific impacts cannot usually be determined until development plans are made (i.e., number and type of wells to be drilled, access routes, production facilities, etc.). Specific land use recommendations for the Adobe Town Wilderness Study Area have not been developed. Land use recommendations will be identified in coordination with the BLM Rawlins District when the Overland Resource Area's MFP is updated in 1982.

Table I-8 also summarizes those MFP recommendations which pertain to the management of oil and gas related activities in the broader sense, rather than at the individual lease level. This includes unit and corridor planning.

Areas of Critical Environmental Concern (ACECs)

Table I-8 identified several proposed planning decisions which would provide more intensive management for critical areas. Some of these critical areas have been identified and nominated as Areas of Critical Environmental Concern (Table I-9). Each of these areas has been nominated because each functions as a crucial element of a particular resource; if special management is not implemented, the resource would be seriously impacted by oil and gas development.

Each ACEC is addressed in Chapter II under the most critical resource as follows: water resources—Red Creek Badlands; wildlife—Pine Butte; recreation—Greater Sand Dunes; and cultural—Cedar Canyon, Oregon Buttes, Natural Corrals, Pine Springs, White Mountain Petroglyphs. Maps II-7A and II-7B (located in Chapter II) illustrate the ACECs in the assessment area.

Table I-7

COMPARISON OF PROPOSED ACTION AND ALTERNATIVES

Affected Resource Component	Proposed Action	Alternative No. 1	Alternative No. 2
Mineral Resources	Increase coordination.	Same as proposed action.	No action.
Geology	Special consideration for 228,300 acres of potential landslide areas.	Same as proposed action.	No action.
Soils	Develop stipulations for 1,489,002 acres of highly erodible soils.	Same as proposed action.	No action.
Watershed	Restrict activity on 941,003 acres which includes establishment of one ACEC.	Same as proposed action.	Restrict activity on 91,000 acres.
Vegetation	Improve reclamation efforts and success on entire area.	Same as proposed action.	Same as proposed action.
Wildlife	Protect 1,586,924 acres of big game winter range.	Same as proposed action.	Protect 946,649 acres of big game winter range.
	Protect 941,031 acres of sage grouse habitat.	Same as proposed action.	Protect 281,000 acres of sage grouse habitat.
	Protect 36,710 acres of elk calving grounds.	No surface occupancy on 36,710 acres of elk calving grounds.	No action.
Livestock Grazing	Restrict activity on 281,836 acres of range lambing grounds.	Same as proposed action.	No action.
Wild Horses	No action.	Restrict activity on 1,661,324 acres of wild horse areas.	No action.
Recreation	Restrict activity within one ACEC (38,480 acres) and within one recreation area (2,560 acres).	Prohibit disturbing activity within one ACEC (38,480 acres) and within one recreation area (2,560 acres).	No action.
Wilderness	Restrict activity on 14 WSAs (258,285 acres).	Prohibit disturbing activity on 14 WSAs (258,285 acres).	Same as proposed action.
Cultural Resources	Establish five ACECs (7,576 acres). Continue present practices.	Same as proposed action.	Same as proposed action.
Aesthetics	Continue present practices.	Same as proposed action.	Same as proposed action.

Table 1-8

RELATIONSHIP OF PROPOSED ACTION TO LAND USE PLANS
Specific Land Uae Recommendations

Number and Resource Area	Proposed Deciaion	Acreage Affected	Effect if Implemented	Status
L-2.1 Salt Wella	Issue oil and gas leases on the public lands within one mile of Point of Rocks and the city limits of Rock Springs and Green River with the stipulation that no surface occupancy will be allowed within the one mile rsdius. Oepend on Sweetwater County to protect privste lands within the one-mile buffer from oil and gas development through zoning or other mesns.	5,760	-Some hydrocarbons in the buffer zone may not be accessible by directional drilling. +Increased public safety.	Increased Restriction
L-2.1 Big Sandy	Administratively close to oil and gas leasing sll federal lands within the Rock Springs proposed expansion area (Tps. 19-20 N., R. 105 W.). Stipulate no surface occupancy on oil and gaa leases issued within one mile of the boundary of other concentrated population areas within the planning unit. This action is being taken to protect the population from the accidental release of hydrogen sulfide (sour) gas.	4,000 19,200	+Potential hindrance to urban expansion will be svoided in expansion ares. -Some hydrocarbons may be inaccesaible in the buffer zone.	Increased Reatrictinn
L-5.1 Salt Wells	Accept applications for communication sites on Aspen Mountsin only if applicants agree to share use of existing facilities. Reserve the remaining tract of federal land for present and future needs of the Buresu of Land Management and other federal, state, county, and city governmental agencies.	--	-Alternate sites will be required. +Impscts on Aspen Mountsin will be limited to preaent aituation.	Increased Reatriction
L-4.2 Big Sandy	Protect the scenic values along Highway 28 within Fremont County. All proposed lands actions within view of the highway will be evaluated for impacts and those impacts mitigated to protect the scenic value of this historical area.	--	-Permanent facilities in thia area will have to be specially designed. +Visual resource enhanced.	Increased Restriction
W-1.1 Big Sandy/Salt Wells	In areas with a vegetal soil factor of 3, require all applications for land use to be accompanied by a detailed soil conservation plan.	1,489,002[1/]	-Delay and complicate approval of projects. + Prevent or reduce adverse impacts.	Increased Reatriction
W-3.9 Big Sandy W-3.6 Salt Wells	Water quality plans will be required prior to construction of drill site mud pits to be sited within a 100-year floodplain or within 1/8 mile of an ephemeral or perennial stream.	--	+Increase reclamation success. +Protect water quality. -Increase approval time.	Increased Restriction
W-3.7 Big Sandy W-3.11 Salt Wells	Reduce sediment and enhance water quality in the following watersheds: 4 J Baain — Killpecker Creek Vermillion Creek — Pacific Creek/Jack Morrow Upper Bitter Creek — Ory Sandy Creek Upper Salt Wells — 18-Mile Canyon Upper Green River Set priorities for development of watershed plans in Fiscal Year 1983.	873,945[1/]	-Will dictate additional constraints on development. +Will reduce sediment and enhance water quality.	Incressed Restriction
W-6.1 Salt Wells	Give the Red Creek Waterahed special protection through designation as an Area of Critical Environmental Concern. Coordinate steps with other BLM programs to achieve the following objectives stated in the 1980 Red Creek Watershed Management Plan: 1. Reduce gully erosion 2. Reduce streambank erosion 3. Reduce peak flow 4. Limit surface disturbing activities 5. Increase perennial grasses 6. Improve livestock distribution 7. Improve wildlife distribution 8. Establish water gauging/water quality monitoring station	67,058	-Will dictate additional constraints on development. +Will reduce sediment and enhance water quality.	Incresse Reatriction

Table 1-8 (Continued)

Number and Reaource Area	Proposed Decision	Acreage Affected	Effect if Implementad	Status
WL-6.1 Salt Wella WL-9.1 Big Sandy	In order to protect nests and surrounding habitat of eagles, peregrine and prairie falcons, and ferruginous hawks, keep surface diaturbance within roughly 1/2 to 1 mile to e minimum. Distance will vary according to species of raptor, terrain, vegetative screening, and type of activity. Authorize no action within thia zone thst would destroy nesting aites.	--	-Requlre aome epacing adjustmenta and aome directional drilling. +Protect raptors.	Praaent Practice
	Alao protect cliffs, bluffs, rock outcrops, and pinnaclee with potential raptor nest aitea (golden eagles, red-tail hawks, and prairie falcons).	--		
WL-8.3 Salt Wella	Keep surfsce disturbance with boundariea of identified prairie dog towns outside of the Rock Springs Known Recoverable Coal Resource Area to a minimum. In addition, write Habitat Manegement Plans (HMPs) for key wildlife apecies eaeociated with the prairie dog ecosystem, (burrowing owl, ferret, golden eagle, ferruginous hawk). Cooperete with the Wyoming Game and Fish Department to discourage recreational shooting of prairie doga within tha planning unit.	--	No chenge.	Present Practice
WL-9.1 Salt Wells	Recommend dealgnatlon of Pine Butte aa en Arae of Critical Environmental Concern (ACEC) to protect potential peregrine falcon hahitat. Allow no eurface diaturbance on Sections 4 and 8, T. 15 N., R. 100 W. Acquire the aurfece and minerala of private lands around Pine Butte (Sectione 3 end 9, T. 15 N., R. 1DD W., end Section 33, T. 16 N., R. 10D W.) to more effectively protect and manege this important raptor area.	44D	+Protect important naturel faeture. -Some hydrocerbons may not be eccessibla.	Increaaed Restrictlon
WL-6.4 Big Sendy	Exerclae aeaaonal road cloaures near Steamboat Rim during the months of May and June to prevent dieturbance during elk calving periods.	3D,515[1]/	- Require annual plenning hy operatora. + Protect a unique elk herd.	Incraeaed Restriction
WL-3.5 Big Sandy	Require that surface disturbing activitiea be allowed no cloaer than 66D feet of live water atreams and 5OD feet of streambeds of major ephemeral waterwaye. Mineral leaaee will be iasued with thia atipulation.	Entire Area	No change.	Preeent Situation
WL-9.3 Big Sandy	Attempt to acquire by land exchange additionel high quality raptor hahitst at Bleck Rock. Withdraw the lsnd to preclude mineral entry. Mineral leaeing will be allowed with no surface occupancy. Daeignate an undlaturbed buffer zone ln a one mile radiua of the cliffs.	--	- Require spacing weivers and directional drilling. + Protect raptors. -Soma minarala could not be extracted.	Increeaed Restriction
WL-9.4 Big Sandy	Withdrew 2,56D acrea of Oregon Buttea from minerel entry to aaaure maintenence of this unique area. Protect the srea from the impact of mineral production through etringent leese etipulations.	2,560	- Require spacing edjustments and aome directional drilling. + Protect unique features.	Increased Reatriction
WL-9.7 Big Sendy/Selt Walls	Allow no activity or dieturbance within 1/4 mile from the center of a aage grouse atrutting ground. Reetrict activitiee within an additionel 1 3/4 mile radiua of theae breeding complexee. Allow petroleum exploration end drilling within thia 1 3/4 mile buffer zone during the period of June 15 until March 1, providing strict requirements for rehebilitation are enforced.	14,742[1]/ 941,031[1]/	+Protect aage grouse populetions. -May require epacing weivars or diractionel drilling.	Present Situation
WL-9.8 Big Sendy/Salt Wells	Reetrict activity within big game winter rangea between the perlod from December 16 to March 31.	1,471,724[1]/	+Protect wildlifa populetioes. -Restrict flexibility in developaent.	Presant Situation
R-1.2 Big Sandy	Protact the naturel valuas of tha Boar'a Tusk, Pilot Butte, Emmon'a Cone, Staamboet Mountain, and Elk Mountain from the impacts which raault from mineral development through the enforcement of apecial etipuletions such aa no aurface occupancy.	10,240[1]/	+Protect unique natural features. -May require directional drilling or spacing waivers.	Increased Restriction
R-1.3 Big Sandy	Manege the Wind Rivar Front, Oregon Buttes, Honeycomb Buttes, Steamboat Mountain, Killpecker Sand Dunes, and Cadar Canyon to assura thair continuing value for recraational opportunitias. Activity plens will be devaloped which will provide for praservation and maoagement.	135,000[1]/	+Protect unique natural featurss. -May require directional drilling or spacing waivers.	Increaaed Restriction

Table I-8 (Continued)

Number and Resource Area	Proposed Decision	Acreage Affected	Effect if Implemented	Status
R-1.5 R-1.6 R-1.7 R-1.8 Big Sandy	Protect the natural values of the Greater Sand Dunes, the Oregon Buttes, the Natural Corrals, and Cedar Canyon by nominating them as Areas of Critical Environmental Concern (ACECs). The nomination of these areas as ACECs may result in: protective stipulations (or, in some cases, administrative closure) to limit the impacts associated with mineral development; limited access for ORVs; and/or patrol and detection to prevent damage to resources.	48,000[1/]	+Protect unique natural features. -Some hydrocarbons may be lost.	Increased Restriction
R-1.9 Big Sandy	Upon promulgation of paleontological regulations, inventory and then develop an activity plan for the Farson Fossil Fish Beds. Process a protective withdrawal to close the 1,280 acre area to mineral entry and leasing.	1,280	-Loss of potential hydrocarbons. +Protection of unique resource.	Increased Restriction
R-4.3 Salt Wells	Sign the Sugarloaf petroglyphs and protectively fence and sign Pine Springs by the end of 1983; initiate patrol and surveillance of the Pine Springs site. These sites should also be placed within protective withdrawals. In addition, designate Pine Springs as an Area of Critical Environmental Concern.	80	+Protect unique values -May require directional drilling or spacing waivers.	Present Situation
R-5.5 Big Sandy	Nominate White Mountain Petroglyphs as an Area of Critical Environmental Concern for the areas cultural values. The area will be protected by fencing of the petroglyphs, and enforcement of special stipulations to protect the area from defacement.	20	+Protect unique values -May require directional drilling or spacing waivers.	Present Situation
R-8.3 Big Sandy	Develop a detailed management plan for the 14-Mile Recreation Area and place atringent stipulations on oil and gas operations to assure protection of the area.	2,560	-Require directional drilling. +Protect popular recreation resource.	Increased Restriction
R-6.1 Salt Wells R-10.1 R-10.2 R-10.3 Big Sandy	Manage the following Wilderness Study Areas under the Interim Management Policy and Guidelines for Lands Under Wilderness Review until they are either dropped from further wilderness consideration or Congress designates them officially as wilderness areas: WY-040-401 and 402 Devils Playground-Twin Buttes WY-040-406 Red Creek Badlands WY-040-408 Adobe Town WY-040-307 Sand Dunes WY-040-335 Mill Creek WY-040-323 Honeycomb Buttes	188,126[1/]	-Development on post FLPMA leases is constrained. +Wilderness values are protected pending decision.	Present Situation
	General Land Use Decisions			
L-4.1 Big Sandy/Salt Wells	Establish utility corridors in cooperation with industry, private landowners, and government agencies. This will require development of utility corridor plans prior to the end of Fiscal Year 1983. Upon establishment of utility corridors, restrict additional utility lines along Interstate 80 between Point of Rocks and Green River (this is the existing corridor which parallels I-80) to local distribution service lines.	Entire Area	+Many adverse impacts would be mitigated. -Cost sharing requirements may have to be developed and enforced. Some pipelines, etc. may be more expensive.	Increased Restriction
M-1.1 Salt Wells M-2.3 Big Sandy	Keep the entire area open to geophysical exploration snd process and approve all notices of intent to conduct geophysical exploration (subject to appropriate surface protection stipulations).	Entire Area	No change.	Present Situation
M-2.2 Big Sandy M-1.2 Salt Wells	Keep the entire area open to oil and gas leasing (subject to appropriate surface protection and rehabilitation stipulations), with the exception of those lands in the Rock Springs proposed expansion area and in Wilderoess Study Areas. Process all Application/Permits to Drill (APDs) in a timely manner.	Entire Area	No change.	Present Situation

Table 1-8 (Continued)

Number and Resource Area	Proposed Decision	Acreage Affected	Effect if Implemented	Status
M-1.3 Salt Wells M-2.1 Big Sandy	Continue to develop surface protection and rehabilitation plans for all producing oil and gas fields and units within the area with coordination and cooperation with the Geological Survey and the operators. Give top priority to old and depleted fields such as Black Buttes Creek, Middle and South Baxter Basin, Bartlette, Six mile, Leo, and Antelope.	Entire Area	No change.	Present Situation
W-1.2 Big Sandy/Salt Wells	Manage known fragile areas throughout the area so as to maintain or reduce erosion levels and improve vegetation cover. Study the remainder of the planning unit to identify additional fragile areas, and where appropriate, develop guidelines necessary	Unknown	+Reduce erosion. -Constrain development.	Present Situation
W-2.2 Salt Wells	Grade, drain, and surface roads with significant erosion potential in high use areas. In addition, cooperate with users to provide free materials (gravel) to be used for surfacing major roads on the BLM transportation plan.	Entire Area	+ Reduce erosion. + Improve multiple use of roads.	Decreased Restriction
W-2.6 Big Sandy	At the direction of the Area Manager, developers may be required to take soil samples and prepare soil conservation plans for projects involving disturbance of large surface areas and for projects in known problem soil areas.	Entire Area	+ Preclude soil loss. - Focus solutions.	Increased Restriction
W-2.7 Big Sandy	Inventory roads and trails to determine those causing erosion and degradation of water quality. Road rehabilitation or road closures will be implemented. Any road closures will be coordinated with private landowners, local government, and principal users.	Entire Area	+ Reduce erosion. - Focus solutions.	Increased Restriction
W-3.8 Big Sandy W-3.5 Salt Wells	Require that all new road construction meet minimum BLM and Wyoming Highway Department standards. Restrict construction across ephemeral or perennial streams during spring runoff.	Entire Area	- Increase cost of development. + Prevent or reduce adverse impacts.	Increased Restriction
W-3.13 Big Sandy	Develop a plan to demonstrate the benefit of snow utilization in reclamation of oil and gas drill sites.	Entire Area	+ Increase reclamation success.	NA
W-3.14 Big Sandy/Salt Wells	Implement a program to monitor water quality for all water wells drilled in the area. All data is to be entered into the Geological Survey WATSTORE system and the University of Wyoming WRDS system.	Entire Area	- Increase reporting and disclosure requirements. + Improve public data base.	NA
WL-2.1 Salt Wells WL-8.1 Big Sandy	On deer crucial winter ranges where vegetative manipulation is planned or other vegetative disturbance has occurred, include a variety of high quality shrub seeds such as winterfat, shadscale, four-wing saltbush, and, in certain instances, mountain mahogany and antelope bitterbrush, to complement the usual grass mixture.	Entire Area	- Increase reclamation costs. + Mitigate habitat loss to development.	Present Situation
WL-5.4 Salt Wells	Do not require sagebrush seed to be included as part of the seed mixtures used in reclamation of disturbed areas.	Entire Area	+ Decrease cost and complexity of reclamation.	Decreased Restriction
WL-3.9 Big Sandy	Modify existing stream crossings (i.e., culverts) which are impeding the movement of aquatic life forms. Assure all proposed stream crossings are designed so as not to obstruct aquatic movement.	Entire Area	- Slight increase in development cost. + Aquatic habitat enhanced.	Increased Restriction
S-3.3 Big Sandy S-3.2 Salt Wells	Assume full maintenance for all high use roads on the area transportation plan. Maintenance is to be accomplished by contract or force account and the cost prorated among commercial users and the BLM according to the extent of use.	Entire Area	+ Increase control of practices. - Additional personnel and equipment requirements.	Increased Restriction

1/ The acres affected by each proposed decision often overlap areas affected by another proposed decision. Therefore, the total acres affected by all of the proposed decisions will be less than the sum of the individual listings.

Table 1-9

AREAS OF CRITICAL ENVIRONMENTAL CONCERN

Name	Location	Size (acres)	Critical Values	Possible Protective Measures
1. Red Creek Badlands (SW)	35 miles S of Rock Springs	67,058	Watershed (highly erodible soils), wildlife	Strictly control disturbing activities from Dec. 15 to May 15. Conduct all activities in accordance with Red Creek Watershed Plan.
2. Pine Butte (SW)	30 miles SE of Rock Springs	440	Wildlife (potential peregrine falcon nest site)	No disturbing activities from March 1 to July 1. Restriction on new roads and utility corridors.
3. Cedar Canyon (BS)	20 miles N of Rock Springs	2,560	Cultural, wildlife, natural system, recreation, scenic	Develop stipulations to restrict mineral development. Access control and interpretation would address public misuse (petroglyph defacement, harassment, or destruction of raptors).
4. (Greater) Sand Dunes (BS)	30 miles N of Rock Springs	38,480	Recreation, scenic, cultural, natural system, wildlife	Develop protective stipulations to restrict mineral development. Limit access for ORVs. Patrol/detection to protect cultural resources.
5. Oregon Buttes (BS)	35 miles ENE of Farson	3,840	Cultural, recreation, scenic, wildlife, natural system	Restrict ORVs and overnight camping to specific areas, develop interpretive trails (nature), patrol/detection to alleviate vandalism, and restrict mineral development.
6. Natural Corrals (BS)	5 miles NE of Superior	1,116	Cultural, recreation, natural system, (geologic values), scenic	Develop stipulations to restrict mineral development and consolidate land ownership through land exchange for uniform protection of values.
7. Pine Springs (SW)	43 miles SW of Green River	40	Cultural, natural system (unique plant community)	No surface occupancy or disturbing activities allowed.
8. White Mountain Petroglyphs (BS)	20 miles N of Rock Springs	20	Cultural, wildlife, recreation	Develop protective stipulations to restrict mineral development. Patrol/detection to prevent defacement of cultural values. Fence off a portion of the site and provide interpretive information.

Abbreviations

BS = Big Sandy Resource Area
SW = Salt Wells Resource Area

Alternative 1 Increase Restrictions

Alternative 1 proposes to increase restrictions on leasing and thereby decrease the area available for leasing. These restrictions would be added to those of the proposed action. Application of these additional criteria would result in 7 percent of the area being closed to leasing, 1 percent of the area open to leasing but no surface occupancy allowed, and 92 percent remaining open with standard or special stipulations. Adoption of these additional restrictions would require amendment of the MFP.

Alternative 2 Continuation of Present Management (No Action)

This alternative would make no changes in present practices, procedures, or stipulations. No additional coordination or standardization would be undertaken between the resource areas. No Areas of Critical Environmental Concern would be established that would not be compatible with oil and gas development. The entire area would be open to leasing with standard stipulations. Only those special stipulations presently employed would be applied.

OTHER ALTERNATIVES CONSIDERED

The following alternatives were considered but dropped from detailed analysis because they were either unreasonable or insupportable.

No Leasing

This alternative would set such stringent environmental protection restrictions that no leasing would be allowed within the area. Under this alternative no new leases would be issued by BLM, and current leases would not be renewed as they expire.

Closure of the entire area to additional oil and gas leasing is not a viable alternative under present legal and Bureau policy. Closure of the entire area to leasing is also unreasonable in view of national energy needs and policies.

Furthermore, BLM believes that in most cases, environmental protection can be assured during oil and gas development activity through judicious use of construction and reclamation stipulations.

Reduced Environmental Protection

This alternative would reduce the number of environmental protection measures currently existing (subsequently opening more areas to leasing than under the proposed action). This alternative was considered and rejected. No new information is available to indicate that the degree of protection BLM offers under its current land use decisions is too great. On the contrary, resource value considerations support increasing the degree of environmental protection.

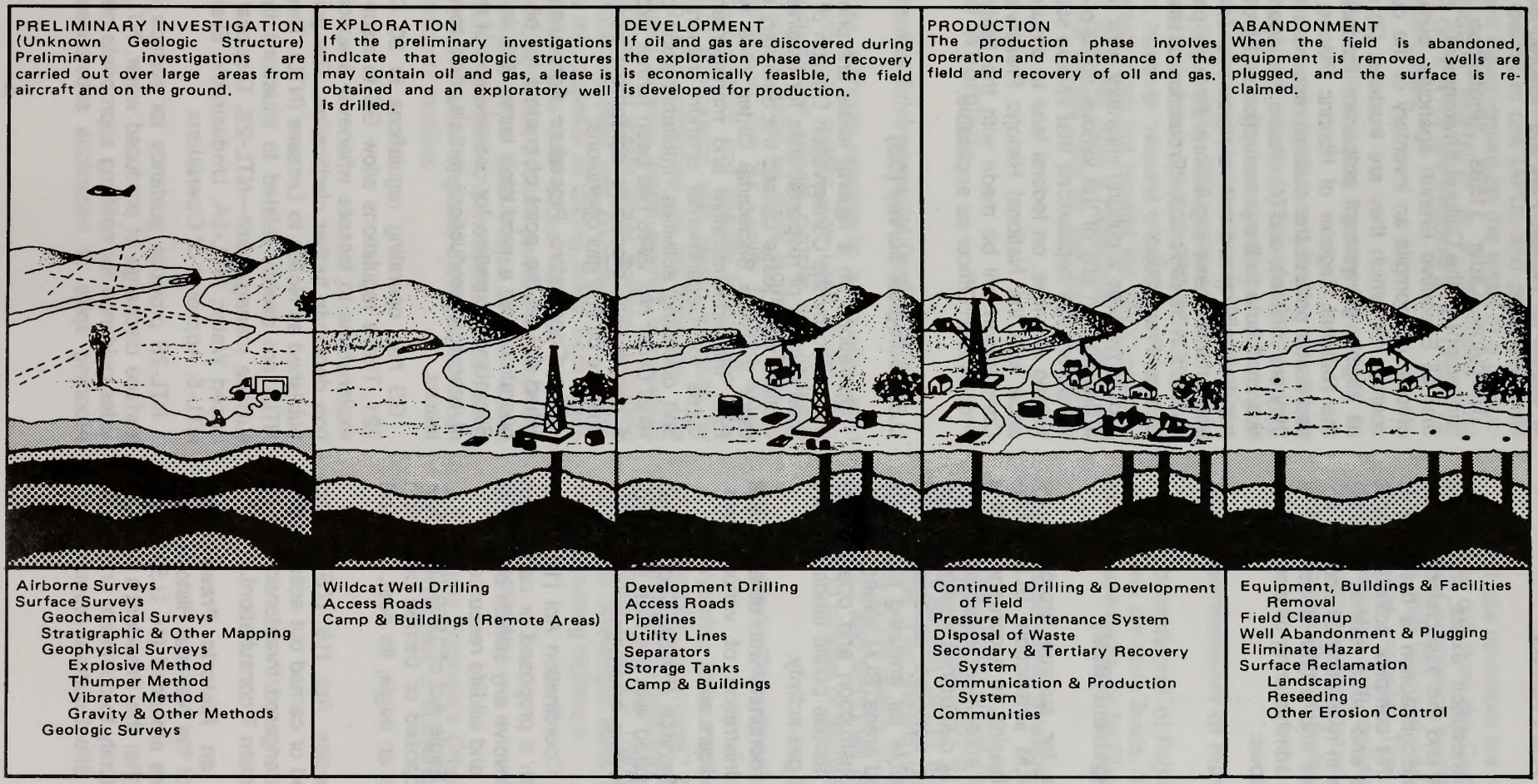
DESCRIPTION OF OIL AND GAS ACTIONS

This section briefly summarizes the progression of activities surrounding oil and gas leasing. Issuance of the lease itself is an administrative action which has no direct effect on the environment. It is the associated activities that result in impacts. Table I-10 shows the phases of oil and gas development and production on federal lands, responsible agencies, and general types of impacts associated with each phase. Figure I-1 illustrates the sequence of operations in an oil and gas field. The phases, as shown, are not truly distinct but rather represent identifiable points on a continuum. Within the assessment area, all phases are going on simultaneously. It is even possible that all may be taking place in the same field. A field may have been developed for a particular, relatively shallow formation and be undergoing geophysical exploration and exploratory drilling in deeper formations. Geophysical exploration may be carried out by an oil and gas lessee to gain further information about the lease, but it is most often conducted by independent geophysical operators on unleased lands. The geophysical operator then sells the data to interested parties who, in turn, may attempt to lease the lands if the seismic data is favorable. Appendix A describes the phases in more detail. Further information can be obtained from the publication, *Surface Operating Standards for Oil and Gas Exploration and Development*, second edition, prepared by the BLM, Geological Survey, and Forest Service (August 1978). This publication is available in the Rock Springs District Office.

Table I-10

SUMMARY DESCRIPTION OF OIL AND GAS ACTIONS

Phase	Typical Activities	Responsible Agency	Method of Authorization	Type of Impacts
Geophysical Exploration	Seismic.	BLM	Provide list of practices to be followed.	Dust, noise, minor sedimentation, slight vegetation loss.
Leasing	Competitive or noncompetitive leasing.	BLM	Lease	None
Exploration and Development	Exploratory drilling.	BLM, GS, State	APD, ROW, Permit	Road and drill site construction, noise, dust, visual, sediment, loss of vegetation, disturbance of wildlife.
	Unitization.	GS	Unit Agreement Plan	
	Development drilling.	BLM, GS, State	APD, ROW, Permit	
	Support facility construction.	BLM	ROW	Construction related vehicle travel, increased human activity, road and facility maintenance.
Production	Additional development drilling.	BLM, GS, State	APD, ROW, Permit	Continuation of exploration and development impacts and construction of pipelines and facilities, noise, odor, continued human presence.
	Additional support facility construction.	BLM		
	Transmission and treatment of gas, oil and condensate; support activities.	ICC, GS, BLM, DEQ, EPA	ROW, Permit	
Abandonment	Removal of facilities and reclamation.	GS, BLM, State	Stipulation, Bond, Permit	Noise, dust, decrease in human presence, increase in vegetation.



SOURCE: U.S. Department of the Interior, BLM, 1972. Preliminary Draft, Upland Oil and Gas Leasing Programmatic Environmental Statement.

Figure I-1
SEQUENCE OF OPERATIONS IN AN OIL AND GAS FIELD

AUTHORIZING ACTIONS

A widespread misconception exists concerning oil and gas operations and the associated impacts on BLM lands. The misconception is that BLM is the sole regulator of this complex activity. This is not the case as state and other federal agencies have a substantial role in regulating oil and gas activities. These agencies and a brief description of their responsibilities in administering oil and gas activities are listed as follows:

Federal

Bureau of Land Management (BLM)

BLM is responsible for surface protection on public lands under BLM jurisdiction. BLM determines stipulations for leasing. In accordance with a cooperative procedure agreement established with Geological Survey, BLM determines stipulations for any surface disturbing activities associated with drilling and is responsible for ensuring successful reclamation of disturbed areas. BLM issues right-of-way grants for the construction and operation of various facilities on or across public lands that are associated with oil and gas activity.

BLM is required to coordinate with other federal agencies in the administration of various laws. Some of the most significant are:

Fish and Wildlife Service (FWS). Coordination and consultation is required with the Fish and Wildlife Service in the following environmental circumstances:

1. Fish and Wildlife Coordination Act (16 *U.S.C.* Sec. 661 *et seq.*) when a proposed or carried out action would or could involve any stream or body of water and affect a fish and wildlife resource.

2. Bald and Golden Eagle Act of 1969 (16 *U.S.C.* 668-668c) when a proposed or carried out action would or could involve an eagle, its nest, and (or) its habitat.

3. Endangered Species Act (16 *U.S.C.* Sec. 1531) when a proposed or carried out action would or could involve an endangered/threatened species and (or) its habitat (Section 7 consultation).

Advisory Council on Historic Preservation (ACHP). Section 106 of the National Historic Preservation Act of 1966 as amended (16 *U.S.C.* Sec. 470 *et seq.*) requires that the President's advisory council have an opportunity to comment on any undertaking which could affect cultural resources on, or eligible for inclusion on, the National Register of Historic Places.

Executive Order 11593, "Protection and Enhancement of the Cultural Environment," mandates that all Executive Branch agencies, bureaus, and offices: (1) compile an inventory of the cultural resources for which they are trustees; (2) nominate all eligible government properties for inclusion on the National Register of Historic Places; (3) preserve and protect the cultural resources for which they are trustees; and (4) ensure that agency activities contribute to the preservation and protection of non-federally owned cultural resources. The Council implements these regulations through procedures outlined in 36 *CFR* 800, "Protection of Historic and Cultural Properties."

BLM requires a cultural inventory prior to making a decision on any of the various rights-of-way and temporary use applications that involve surface disturbing activities, on federal land to ensure compliance with the National Historic Preservation Act. Consultation will be made with the State Historic Preservation Officer as applicable.

U.S. Geological Survey (GS)

Operations on a federal lease are primarily administered by the Conservation Division of GS. The wide division of responsibilities for leasing and operations on a lease caused the Secretary of the Interior to issue Secretarial Order 2948 which set forth the administrative and management procedures for Departmental onshore mineral leasing and operating activities. Implementation of Secretarial Order No. 2948 has been further explained in a cooperative procedure agreement pertaining to onshore oil and gas operations.

The Cooperative Procedure Agreement established GS as the point of contact for oil and gas operations on a producing lease. GS is also the Secretary's expertise for conservation of the mineral resource, production, rentals, and royalties on leases.

GS has operating regulations in 30 *CFR* Part 221. These regulations allow GS to issue detailed explanations to lessees whenever a specific situation demands further clarification. The guidance is published as Notice to Lessees (NTL). Three of the NTLs are directly related to situations that affect surface management—NTL-2B, Disposal of Produced Water; NTL-3A, Undesirable Events; and NTL-6, Approval of Operations.

NTL-2B provides guidance for surface and subsurface discharge of produced water. NTL-3A provides guidance for notifying appropriate offices and reporting spills of hazardous substances. NTL-6

provides guidance to operators when filing applications for permit to drill (APD); and applications for subsequent development on the lease at a producing or support facility, or in a developed field. Copies of GS's NTLs are available in all Conservation Division offices.

Environmental Protection Agency (EPA)

EPA has issued regulations affecting all oil and gas lessees and operators (Title 40 *CFR* Part 112). These regulations require owners or operators to prepare Spill Prevention Control and Countermeasure Plans (SPCC plan). EPA does not make special inspections to see that operators have SPCC plans. They can, however, request one from an operator; if an operator does not provide the SPCC plan, he is subject to a fine. After a hazardous material spill occurs, EPA usually calls for the operator's SPCC plan.

State of Wyoming

Department of Environmental Quality (DEQ)

DEQ has authority relating to air quality, solid wastes, and water quality. The Land Quality Division responsibilities include permits and reclamation for material sales on state lands such as fill, sand, and gravel. The Air Quality Division issues permits to construct and permits to operate after approval of applications with regard to plans for monitoring and controlling air contaminants. The Water Quality Division issues permits to construct settling ponds and waste water systems, including ground water injection and disposal wells. It also regulates the disposal of drilling fluids from abandoned reserve pits and issues National Pollutant Discharge Elimination System permits for discharging waste water. The Solid Waste Division issues construction fill permits and industrial waste facility permits for solid waste disposal during construction and operation of facilities.

Oil and Gas Conservation Commission

Oil and gas operators are required to receive permission to drill from the Commission prior to operation. The Commission controls well spacing (in cooperation with GS) and has the final authority on well location variance. The Commission approves unit agreements and controls water and gas injection systems and underground gas storage projects. They also regulate the flaring and venting of natural gas.

State Commissioner of Public Lands

The Commissioner of Public Lands issues oil and gas leases on state lands. The commissioner also issues easements for facilities crossing state lands.

State Historic Preservation Officer (SHPO)

The state liaison officer for the Advisory Council on Historic Preservation is consulted for compliance with Section 106 of the Historic Preservation Act of 1966. If an undertaking would cause damage or change in the quality or the character of a site, the Council and SHPO will consult with the agency on ways to remove or mitigate the effect.

State Highway Department

The Wyoming State Highway Department issues state "Permits to Access" for all proposed roads that connect onto Highway Department rights-of-way on state and U.S. highways. Permits for oversized and overweight loads are required for trucks using Wyoming highways.

State Engineer

The State Engineer's Office issues water permits for use of surface or subsurface water.

CHAPTER II

AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES

This chapter of the environmental assessment describes both the impacts of oil and gas activity and those resources being affected. As this EA is a supplement to the BLM land use planning system, it will not unnecessarily repeat information contained within the planning documents. The Big Sandy and Salt Wells resource areas have recently updated their Unit Resource Analysis (URA). The URA contains detailed information about the area, supported by maps, tables, and illustrations. Appendix B gives a brief overview of the URA and is designed to aid interested parties in using the URAs, which are available for public review in the resource area offices.

Only those specific environmental components which may be affected by oil and gas activities are addressed here.

ASSUMPTIONS AND ANALYSIS GUIDELINES

1. Impacts are estimated through 1991.

2. Impacts remaining after reclamation are considered irreversible and long term.

3. Reclamation of disturbed land is considered complete when the equipment has been removed and the disturbed land has been recontoured and revegetated. Reclamation of a well site or an access road begins when the well is completed or abandoned. Recontouring and reseeding of utility lines or pipelines usually begins after construction of the project is completed.

4. Projections of oil and gas activities are speculative, at best. Technology and market conditions are changing more rapidly than they have during any recent period. The two-year period of 1979-1980 is used as the base period for projection purposes, and activity is projected on an even basis through 1991 (Table II-1).

5. Tables II-2 and II-3 summarize the acreage, typical impacts, and water requirements implied by the projected level of activity in Table II-1.

6. It is assumed that the oil and gas industry will maintain its present level of importance in the area for the first five years and then begin to decline in relative importance as activity increases in coal and sodium.

7. Impact identification is based on the following premises:

A. BLM specialists will identify all potential conflicts.

B. BLM specialists will recommend necessary stipulations to mitigate impacts.

C. Geological Survey and operators will accept all recommended stipulations.

D. Operators will adequately and completely convey stipulations to their contractors and employees, and ensure compliance.

E. Violations will be quickly detected and immediately corrected.

8. It is assumed that the beneficial and adverse impacts discussed could occur on private or state land as well as public lands. Mitigating measures may be identified to the state or private landowners, but no mandatory requirements can be made by BLM.

AFFECTED ENVIRONMENT AND IMPACTS OF THE PROPOSED ACTION

Climate

Climate in the area is not impacted by oil and gas development; however, climate influences many of the other components of the environment which are most directly impacted such as air quality, vegetation, and soils. The harsh, dry climate places a severe limitation on revegetation efforts in the area.

The climate of the assessment area is classified as semi-arid cold desert. Precipitation averages 7-13 inches per year throughout the assessment area with a few areas, primarily the Wind River Front having a 15-20+ precipitation zone. As with most high desert climates, precipitation is highly variable and unreliable. Furthermore, southwestern Wyo-

Table II-1

PROJECTED LEVEL OF OIL AND GAS ACTIVITIES[1/]

	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991
Producing Locations	645	674	706	741	776	822	910	960	1,040	1,100	1,180	1,180	1,170
Drilling Completions	84	92	90	90	90	80	70	60	50	40	30	20	20
Shut-in[2/] Producers	202	230	260	290	310	340	300	260	200	150	100	100	100
Abandoned Locations (estimated)	750	777	840	868	896	924	956	976	996	1,034	1,044	1,074	2,004

1/ These figures were projected primarily from 1979 activity with any available data from 1980-1981. The number of state permits to drill, filed and approved APDs, well completion reports, industry's monthly drilling reports and estimates, were evaluated and used as the bases for these projections.

2/ An increase in this category assumes a temporary shortfall in gathering line and treatment facility.

Table II-2

ACRES OF DISTURBANCE AND TYPICAL IMPACTS
ASSOCIATED WITH OIL AND GAS ACTIVITIES

Activity	Acres Affected	Initial Impact	Residual Impact
Seismic Exploration	0.5 acre per mile[1/]	Vegetation disturbed by passage of convoy, some drainage crossing required, some dozing and blading, sediment from drill hole cuttings.	Ruts persist on some soils, gullying may develop on steep slopes.[2/]
Drill Site/Production Location (less than 6,000 feet in depth)		All vegetation is destroyed, topsoil is stockpiled off site. Location is leveled. Soil material may be lost to wind and water erosion. Landscape is altered. Degree increases as slope increases. Sediment may reach streams. Noise and odors associated with construction and drilling. Human activity increases measurably.	Site will remain detectable if slope is over 15%. Vegetative discontinuity may remain indefinitely. Visual intrusion will remain on producing locations. Some sediment will continue to be produced if the well site is a producer.
0-10% slope	1.4 + 0.9 = 2.3 acres[4/]		
11-24% slope	1.4 + 1.1 = 2.5 acres		
25-39% slope	1.4 + 1.4 = 2.8 acres[3/]		
40%+ slope	1.4 + 1.9 = 3.3 acres[3/]		
Drill Site/Production Location (greater than 6,000 feet in depth)			
0-10% slope	2.8 + 1.9 = 4.7 acres		
11-24% slope	2.8 + 2.3 = 5.1 acres		
25-39% slope	2.8 + 2.9 = 5.7 acres[3/]		
40%+ slope	2.8 + 3.9 = 6.7 acres[3/]		
Access Road		Vegetation is destroyed in traffic area and barrow area. Noise and dust created by construction. Sediment can reach streams. Landscape is altered.	Visual intrusion remains. Barrow ditches remain. Some dust and sediment will be produced on a continuing basis.[2/]
0-10% slope	3.8 acres/mile		
11-24% slope	4.2 acres/mile		
25-39% slope	7.4 acres/mile[3/]		
40%+ slope	10.2 acres/mile[3/]		
Powerline	0.5 acre/mile	Access routes are disturbed, each tower site is denuded. Noise, dust, and sediment will be produced during construction.	Reclamation will remove most effects. Two-track trails may remain for maintenance.[2/]
Pipeline	1.0-6.0 acres/mile	Vegetation is removed; dust, noise, and possible sediment produced during construction. Drainages crossed.	Visual discontinuity, dust and sediment from maintenance, and steep slopes.[2/]
Compressor Station, Gas Plant, etc.	±5 acres per site	Construction related impacts (vegetation loss, noise, dust, etc.) and socioeconomic impacts commensurate with the size and duration of the impacts.	Undeveloped land takes on an industrial character for the life of the facility.

[1/] Modern seismic exploration methods require little or no surface disturbance

[2/] Most of the residual impacts of these activities are attributable to other uses (e.g., ORV, hunting).

[3/] Standards, policies, and stipulations now minimize activity under these conditions.

[4/] $1.4^a = 0.9^b = 2.3^c$ acres a = operating surface
b = cut slope, fill areas, stockpiles
c = total disturbed area

Table II-3

ACRES DISTURBED AND WATER CONSUMED DURING THE ANALYSIS PERIOD

	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991
Surface Disturbance													
Annual in Acres[1/]	924	1,012	990	990	990	880	770	660	550	440	330	220	220
Cumulative in Acres[2/]	--	1,551	2,123	2,805	3,410	4,246	4,774	4,884	5,104	5,324	5,654	5,654	5,544
Water Consumption													
Acre-Feet Per Year	420	460	450	450	450	400	350	300	250	200	150	100	100

1/ Based on an average of 11 acres per well attempted (4 acres access road, 5 acres drill pad, and 2 acres pipelines and support facilities).

2/ Assuming adequate revegetation of dry holes and abandoned producers.

ming is in an area where the prevailing winds and surface topography are conducive to low rainfall. These elements and westerly winds coupled with north/south axis mountain ranges, place the assessment area in a "rainshadow."

Precipitation levels are highest in the spring and late fall of the year. Seasonal temperatures vary from extremes of -30°F. in January to highs of 90°F. and above during July.

Winds in the area are predominantly from the west, although they can vary under extreme climatic conditions. The winds are a major factor in the moisture content of the area. The effect is two-fold: (1) the winds bring in the precipitation containing clouds from the west; and (2) they increase the evaporation rates in the area. The wind velocity averages 12-14 miles per hour (mph) throughout most of the year, often increasing to 25-40 mph during the winter. Strong, gusty winds of up to 80 mph are not uncommon.

At present, specific data pertaining to air inversion layers in the assessment area is not available. Inversions are caused by cold air drainage from areas of higher elevation to a lower, generally basin-type elevation. The morning sun heats the cold air and produces the fog-like inversion layer. In the winter, these inversion layers can last up to ten days but generally only last a day or two. In the summer, they are relatively common in the early morning, generally burning off by about noon. Observations indicate that these inversion layers occur at an altitude of 1,000 feet or less above the land surface. During inversion periods, the particulate matter emitted from the various industrial developments is trapped for the duration of the inversion.

The climatic factors existing in the assessment area are discussed in detail in the URAs. See Appendix B for a guideline to the URAs.

Air Quality

Air quality in the assessment area is generally quite good; however, localized degradation has been noted. Some of this degradation is related to oil and gas activities, although the largest, most noticeable sources are not. This localized degradation is most apparent in the vicinity of the Jim Bridger complex, the cities of Rock Springs and Green River, and in the vicinity of the trona plants west of Green River. The degradation consists mostly of particulate matter (dust and smoke).

Impacts

Oil and gas activities in the area represent a potential impact to air quality. Exploration, development, production, abandonment, and rehabilitation all produce dust and gaseous emissions from vehicles and equipment. Development and production can also produce noxious and even toxic gaseous emissions from the production or processing of the commercial hydrocarbons.

Of growing concern in the area is the potential hazard associated with production of 'sour' gas. Sour gas contains hydrogen sulfide (H_2S) which must be removed before the gas is safe to use. Until recently, it was rarely economically feasible to develop sour gas wells. Sour gas was often deep or of insufficient quantity and value to justify a treatment facility. Increases in gas prices and advances in drilling and treatment technology have eliminated many of these disadvantages, and there is increased interest in sour gas. This will increase the possibility of dangerous accidents involving the release of toxic fumes at well sites which can be lethal. However, properly selected, maintained, and operated drilling equipment will prevent dangerous releases. In addition, the construction of a gas processing plant is a major project, involving several hundred acres, access roads, sulfur transportation systems, and locally significant dust, smoke, and fumes.

Geophysical Exploration. Seismic lines are no longer bladed or dozed except for occasional problem areas. Dust is created by the passage of the vehicles when terrain and/or access routes are dry. Vehicle exhaust emissions will cause minimal impacts.

Exploration and Development. Road and drill site construction account for short-term, localized degradation. Transporting the drilling rig over the unpaved access route will produce large quantities of dust if the road surface is dry and unimproved. When construction and rigging-up take place during dry weather, violations of the state standard of 60 micrograms per cubic meter ($\mu g/m^3$) for total suspended particulates may occur within 0.3 mile of the source. Gaseous emissions from the construction and transportation equipment are present but not significant. As drilling progresses, some dust and vehicle emissions will continue in association with movement of drilling crews and supplies to and from the well site.

Drilling itself utilizes internal combustion engines as a power source on a round-the-clock basis. This produces some gaseous emissions. In addition, drilling may encounter a wide range of gases that may temporarily escape into the atmosphere until contained. During drilling and completion of wells,

hydrocarbons and associated gases may be flared (burned-off) or released into the atmosphere, producing temporary smoke and fumes.

Accidents such as fires, equipment failures, explosions, fuel spills, etc. do occur occasionally during drilling and can cause smoke, fumes, dust, etc.

Production. The construction of production facilities such as storage batteries, pipelines, production units, and processing facilities will produce dust and gaseous emissions commensurate with the number and type of improvements necessary to move the products to market. Once the necessary facilities are constructed, vehicular travel and the associated impacts are greatly reduced. A producing well will typically be visited on a daily basis or less frequently by a company employee known as a pumper. When liquid hydrocarbons are present with gas, they will be collected in tanks and periodically removed by large trucks to pipeline terminals or bulk facilities. Service trucks will visit wells and other facilities periodically. Dust and vehicle emissions will continue to be produced but will fall below the levels sometimes associated with development. Gases will occasionally be released into the atmosphere or flared. Occasional fires will occur. Most pollutants will go unmeasured and unnoticed unless they occur adjacent to recreation or residential sites. In sour gas fields the potential for accidental release of hydrogen sulfide will continue.

Abandonment and Rehabilitation. Abandonment and rehabilitation involves removal of facilities, recontouring, and revegetation. The process uses bulldozers, tractors, and other construction equipment fueled by internal combustion engines. The object of rehabilitation is to restore natural contours and vegetation, and to eliminate the adverse environmental impacts. However, the process is often a type of construction that produces dust, and equipment related emissions. In addition, sites that may have become temporarily stabilized will be redisturbed in order to restore desirable contours, prepare a seedbed, or stabilize a cut, and will once again produce quantities of dust until desirable cover is established.

Geology

The assessment area is dominated by the Rock Springs Uplift which covers an area of approximately 1,400 square miles. The uplift is a large north-trending, double-plunging asymmetric anticline. The Green River Basin borders the uplift on the west with portions of the Washakie Basin and Great Divide Basin bordering it on the east. These two basins are separated by the Wamsutter Arch, a low relief anticlinal structure.

The three basins are structural depressions filled with thousands of feet of Tertiary and older sediments. The oldest sedimentary rock outcrops (Upper Cretaceous) are expressed in the central portion of the Rock Springs Uplift with successively younger rock units cropping out around it. More or less continuous concentric ridges have formed around the long axis of the structure. This is caused by the relative difference in erosion susceptibility between the soft, easily weathered shale and the harder, more resistant sandstone.

On the northeast flank of the uplift, a large area of erosional remnants of Quaternary volcanic activity occur. This area is called the Leucite Hills. Lava flows make up the largest volume. Some cinder cones and a volcanic neck (Boars Tusk) are also present.

Stratigraphy

Within the assessment area a columnar section of rock sequence (see Figure II-1) from the Cambrian age up to the present, contains sedimentary rocks. Many of these formations have produced oil and/or gas in southwestern Wyoming. The most important hydrocarbon formations are those of the Cretaceous age.

Mineral Resources

Within the assessment area there are proven economic reserves of oil and gas, coal, trona, and aggregates. Other resources found in the assessment area include oil shale, uranium, titanium, phosphate, potash, stone, and gold. At present it is not economically feasible to recover these resources.

Oil and Gas. See Chapter I, Background, for information on oil and gas resources.

Coal. Two modern coal strip mines are presently operating in the assessment area. Both mines are located just east of Rock Springs. The coal occurs in rock outcrops within the Rock Springs Uplift. Total coal resources of eight billion tons of subbituminous coal are estimated. The coal presently produced comes from formations of the Cretaceous age (see Figure II-1).

Trona. Known reserves of trona, a sodium mineral, occur in the Green River Basin. One large trona mine and refinery operation (Stauffer Chemical Company) is located 17 miles northwest of the city of Green River and is currently producing 1.82 million tons per year (MTPY) of soda ash. Tenneco Oil

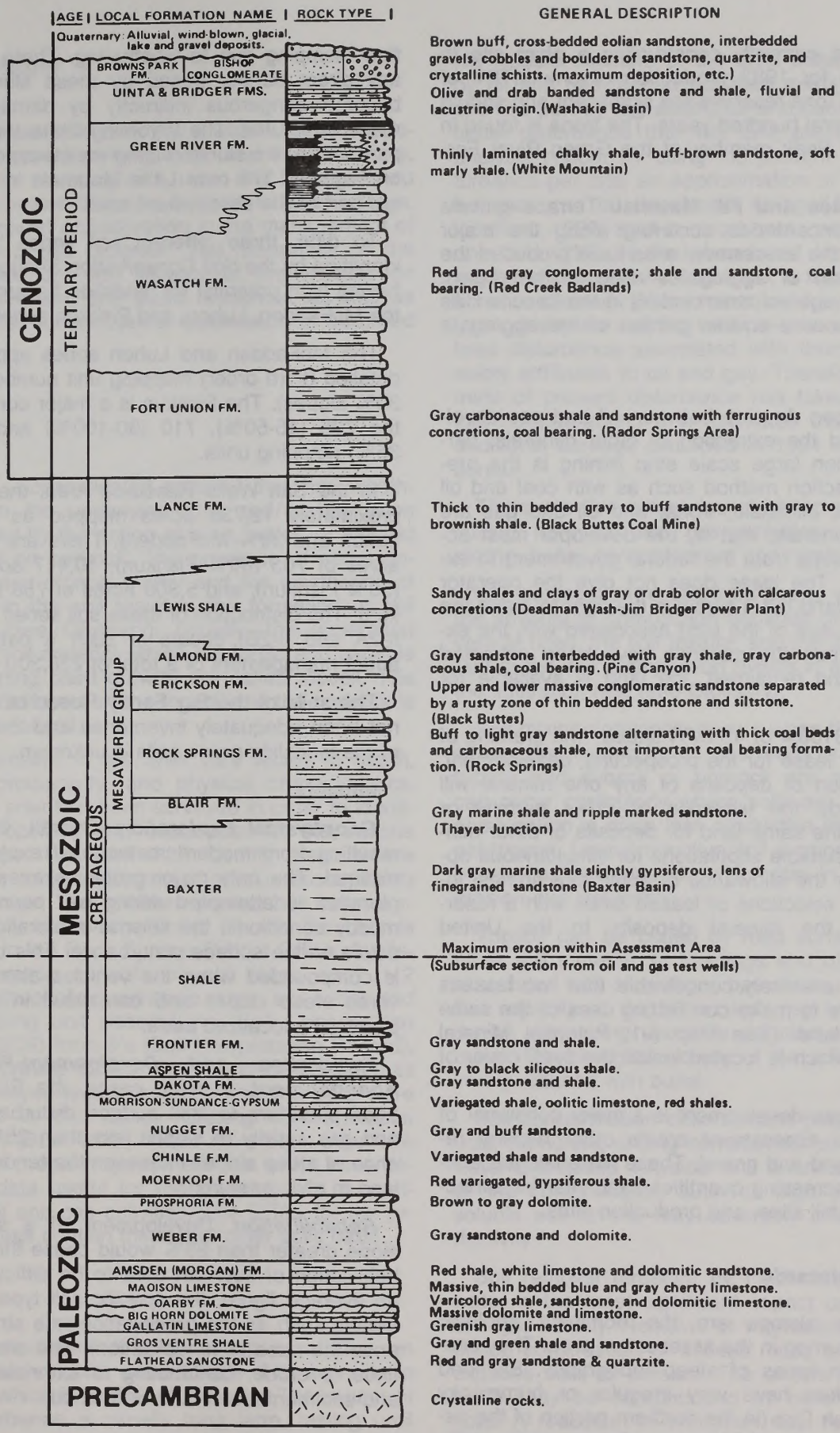


Figure II-1
STRATIGRAPHIC COLUMN
(Vertical sequence of rock formations within the Assessment area)

Company is currently constructing a plant site in preparation for 1982 production of one MTPY of soda ash. Trona reserves are significant and should last for several hundred years. The trona is found in the Wilkins Peak member of the Green River Formation.

Aggregates and Fill Material. Terrace gravels and lag concentrates occurring along the major streams of the assessment area have produced the major portion of aggregates used in the region. Quaternary age volcanic cinders in the Leucite Hills have produced a smaller portion of the aggregate used.

Impacts

Conflict can develop between oil and gas development and the extraction of other minerals, particularly when large scale strip mining is the preferred extraction method such as with coal and oil shale. Coal, oil shale, trona, and oil and gas are leasable minerals; that is, the developer must acquire a lease(s) from the federal government to extract them. The lease does not give the operator title to the land but it conveys the right to make the necessary uses of the land associated with the extraction. When the minerals have been extracted and the land reclaimed, the land is available for other uses.

Section 3100.4 of 43 *CFR* states "the granting of a permit or lease for the prospecting, development, or production of deposits of any one mineral will not preclude the issuance of other permits or leases for the same land for deposits of other minerals with suitable stipulations for simultaneous operation, nor the allowance of applicable entries, locations, or selections of leased lands with a reservation of the mineral deposits to the United States."

Thus, it is entirely conceivable that two lessees could desire to make con flicting uses of the same parcel of land. (See Map II-1, Potential Mineral Conflicts, which is located inside the back cover of this EA.)

Oil and gas development is a major consumer of one of the assessment area's other mineral resources: sand and gravel. These materials are consumed in increasing quantities each year for surfacing roads, drill sites, and production sites.

Geologic Hazards

Earthflow slumps are the dominant geologic hazard occurring in the assessment area. They usually form in areas of steep topography. Slumped hillsides often have very irregular or hummocky slopes. Bush Rim (in the northern portion of the assessment area) exhibits naturally occurring earthflow slumping due to weathering. There is seldom any direct danger posed by these slumps. They become dangerous indirectly by damaging man-made structures. The Wyoming State Highway Department has a slump-related maintenance problem on Highway 373 near Little Mountain in the southern part of the assessment area.

To date, three different soil series have been identified by the Soil Conservation Service (SCS) as having high potential for landslide hazard. They are the McFadden, Luhon, and Pishkun series.

The McFadden and Luhon series appear in the detailed (third order) mapping unit number 591 (10-30% slopes). The Pishkun is a major component of the 705 (15-50%), 710 (30-100%) and 758 (15-35%) mapping units.

In the Salt Wells Resource Area, there are approximately 12,736 acres mapped as 591 (40% Luhon and 30% McFadden). There are also 3,294 acres of 705 (80% Pishkun); 10,417 acres of 710 (50% Pishkun); and 5,308 acres of 758 (50% Pishkun). The distribution of these soil series (see Maps II-2A and II-2B) occurs in such a pattern as to affect management of a total of 228,300 acres.

The soils of the Big Sandy Resource Area have not been adequately inventoried and the incidence of the landslide prone soils is unknown.

Impacts

Geophysical Exploration. Overall, the impacts resulting from modern methods of exploration are minimal. The only major problems arise when exploration is attempted during wet periods. During muddy conditions, the seismic exploration vehicles cause undue surface disturbance. This disturbance is compounded when the vehicles attempt to traverse steep slopes and can result in severe impacts on a localized basis.

Exploration and Development-Production-Abandonment. In most cases, the BLM encourages operators to limit surface disturbance for oil and gas activity to slopes less than 25%. Disturbance of steep slopes increases the tendency of the land to slide or slump.

Rehabilitation. Development of a site with a slope greater than 25% would cause the future rehabilitation of such an area to be difficult. (This is an average figure; the specific soil type and other factors such as the precipitation rate strongly influence the ease of rehabilitation). The site may continue to erode, contributing to extensive soil loss and sedimentation in the watershed.

Topography

The assessment area has a wide variety of topographic features, ranging from mountains, foothills, and valleys to rolling hills, rims, and basins. Steep slopes, whether they are in mountains or valleys, require special consideration in the management of the oil and gas program. The steepness of the slope influences the severity of the impacts on soils, vegetation, and water resources, as well as the chances for successful reclamation of disturbed sites.

Soils

Soil is unconsolidated material that has weathered from the underlying rock and/or has been transported by the action of wind, water, or ice and deposited on bedrock. The presence of some undecomposed organic matter and the weathering of minerals in the soil result in the formation of soil horizons (see Glossary). Usually, the uppermost layers of soil material, which are fertile and capable of supporting plant growth, are called topsoil. The soil material between the topsoil and the bedrock is known as subsoil.

Soils present in the area vary widely in depth, texture, productivity, and physical characteristics. All of the area has been surveyed in order to identify the properties and occurrence of the various soils. Maps II-2A and II-2B identify areas where soils have a higher degree of erosion susceptibility than average. The southern portion has been surveyed fairly intensively (Order III) and the data is available in the Rock Springs District Office. Available information consists of: soil maps on 7 1/2 minute orthophoto quadrangle maps, soil series and soil mapping unit descriptions, Soil Conservation Service (SCS) form 5's (Soil Interpretation Record), and interpretive tables. The northern portion has been surveyed less intensively and the data were published in the *Sandy Grazing Environmental Statement* (BLM 1978). There have been other site specific or problem specific surveys which have developed data useful for the planning and supervision of oil and gas activities. The URAs for the resource areas contain these and other soils data.

Impacts

Soils are disturbed by oil and gas activities on approximately 1,000 acres (Table II-3) annually in the area which is 0.02% of the area. The impact of soil disturbance is usually long term, lasting until reclamation is completed and can be irreversible. No reliable estimate of the area disturbed to date by oil and gas related activities exists. Tables II-1 and II-3 portray the additional and cumulative additional disturbance that will take place during the analysis period. By using the present level of disturbance per site, an approximation of present disturbance can be developed. Using 645 producing locations, 202 shut-in producers, and assuming one-third (250) of the abandoned locations have not been successfully reclaimed, a figure of 12,067 acres is derived. (Many roads used by the oil and gas industry are existing multiple-use roads and the total disturbance associated with them cannot be solely attributed to oil and gas. Therefore, the estimate of present disturbance has taken this factor into consideration.) It is estimated that cumulative additional acreage disturbed in 1991 will be 5,544 acres.

There are five categories of impacts on soils resulting from oil and gas activities: compaction, mixing, burial, contamination, and removal.

Soil compaction results from use of vehicles, and the severity of compaction depends on the type of vehicle used, the soil texture, and the moisture content of the soil. Compaction results in a reduction in the infiltration rate (see Glossary).

Soil mixing commonly occurs when the surface is stripped or leveled for access roads or drill pads. If topsoil and subsoil or bedrock are mixed, which can occur particularly where soils are shallow, the combination is often less productive than the original topsoil. Less productive soil supports sparse or poorer quality vegetation, which may in turn, lead to erosion and soil loss.

Topsoil can be buried by road surface material, other soil material, or buildings and other facilities associated with oil and gas operations. The productive capacity of the buried soil may be greatly reduced, depending upon the duration and depth of burial. The biological activity of the soil may be severely reduced with burial.

Soil contamination occurs when petroleum products, bentonite, drilling compounds, or poor quality water are spilled. Physical and chemical properties of the contaminants, such as high pH and high soluble salt levels, may adversely affect soil productivity.

Soil removal (erosion) by machinery, wind, and water is the most significant impact caused by oil and gas activity. Removal of vegetation and topsoil during construction of access roads and drill pads exposes soils to erosion. The effects of wind and water may be compounded by other impacts to soils. A reduction in infiltration rate, resulting from compaction, or the loss of vegetation due to an oil

spill, causes increased runoff and accelerated erosion.

Soil erodibility varies by soil type and degree of past erosion, when factors such as climate, vegetative cover, and erosion prevention practices remain the same. Some of the soil properties that influence soil erodibility are soil texture; percentage of coarse fragments, especially on the surface; stability of soil structure; type of clay content; soil permeability; organic matter content; and depth of soil material. The rate at which a particular soil type will erode has been computed by the Soil Conservation Service (SCS) through the use of a soil erodibility nomograph using five soil parameters. The five parameters are percent silt plus very fine sand, percent sand (0.10-2.0 mm), organic matter content, structure, and permeability.

The Universal Soil Loss Equation (see Glossary), developed by the SCS, can be used to determine ranges in the amount of soil loss expected from water erosion. This calculation is useful in predicting the probable erosion to be expected from a specific practice at a specific location. The equation also uses the percent slope and slope length which are determined for the site.

The Soil Conservation Service and the U.S. Department of Agriculture's Agricultural Research Service State Experiment Station, both involved in erosion research, have established soil loss tolerance values for most of the soils found within the area. Soil loss tolerance is the maximum amount of soil loss, in tons per acre per year, that can be tolerated and still achieve a degree of conservation needed for sustained economic production. (BLM uses the SCS soil loss tolerance values as a guide for determining the impacts of soil erosion.)

The tendency of a particular soil to erode at a rate greater than its soil loss tolerance when disturbed is erosion susceptibility. Soils with severe erosion susceptibility present particular management problems. Maps II-2A and II-2B depict areas where soils with severe erosion susceptibility dominate the landscape. This does not mean that all soils within the areas are severely erodible or that those outside the identified areas are not severely erodible. The concentration of severely erodible soils within these areas is sufficient to present problems in site selection, construction techniques, and reclamation. These soil areas comprise a total of 1,489,002 acres or 28 percent of the assessment area.

The degree of impact on soils in each case of disturbance is also influenced by topographic characteristics. Field observation by BLM personnel has shown the following slope-related characteristics. On slopes up to 15%, reshaping the disturbed areas and redistributing the topsoil can be adequately accomplished. Reshaping slopes from 15% to 30% is difficult. When roads or drill pads are constructed by conventional cut and fill methods on slopes of 15% to 30%, fill material is lost as it tumbles down the hillside and feathers out on the natural slope below. The soil often buries vegetation, reducing or eliminating its ability to grow and its ability to trap runoff. On slopes in excess of 30%, the excavated material drifts down the hillside to the bottom of the drainages, occasionally injuring or uprooting trees. The material usually is not retrievable by conventional construction equipment.

An alternative to casting cut material over the edges of the hill is hauling it to a stockpile site and saving it for rehabilitation of the road or location. However, as the slope percentage increases, the feasibility of saving and redistributing the topsoil diminishes.

The degree of impact on soils resulting from surface disturbance can be reduced by proper construction and rehabilitation practices. Guidelines for construction and rehabilitation of access roads and drill pads are included in *Surface Operation Standards for Oil and Gas Exploration and Development*; a booklet published by the Geological Survey, the Bureau of Land Management, and the Forest Service, and is available in the BLM Rock Springs District Office. The purpose of the guidelines is to reduce damage to the soils and, in turn, to vegetation, wildlife, and other land uses. Adherence to these guidelines could minimize adverse impacts to soils.

Table II-4 shows the types of impacts to soil associated with oil and gas activities. This table assumes that the proper practices referenced above are strictly adhered to. Soil erosion is minimized or virtually eliminated by strict adherence to proper construction and prudent operating standards. Most soil erosion results from:

1. Failure of BLM to properly analyze routes and design, overlooking problem areas;

2. Operating under adverse conditions, primarily wet and muddy roads;

3. Inadequate design or improper maintenance of roads and other improvements (improper installation or maintenance of culverts can have a particularly adverse effect, resulting in headcutting and/or gullying); and

4. Failure of contractors to adhere to the standards set by BLM and GS.

N

Designated Problem Watersheds

Areas With High Percentage of Soils With Severe Erosion Susceptibility

Scale: 1:500,000

10 0 10 20 Miles

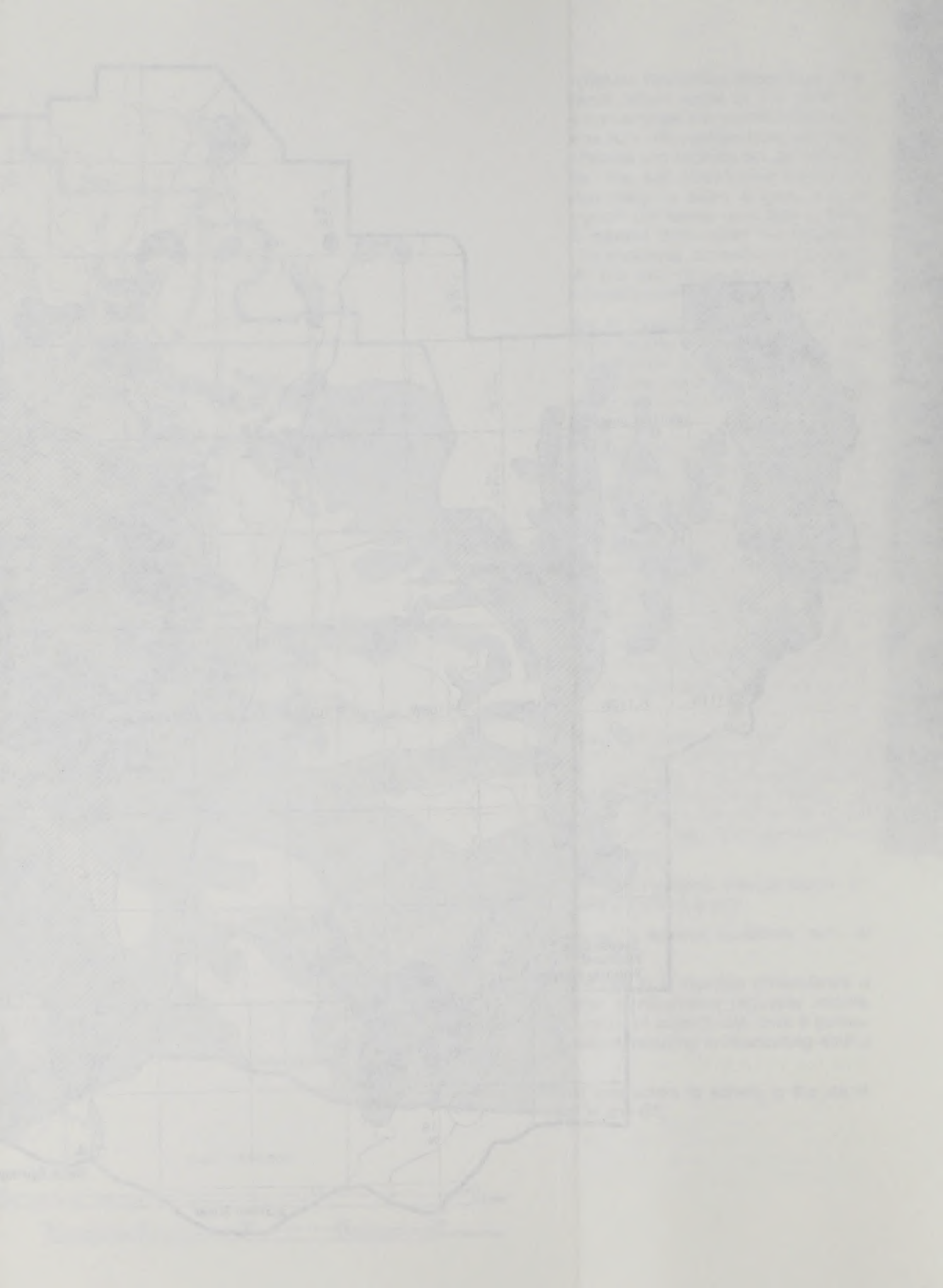
10 0 10 20 30 Kilometres

Map II-2A

MANAGEMENT CONSIDERATIONS SOILS AND WATERSHED

BIG SANDY RESOURCE AREA

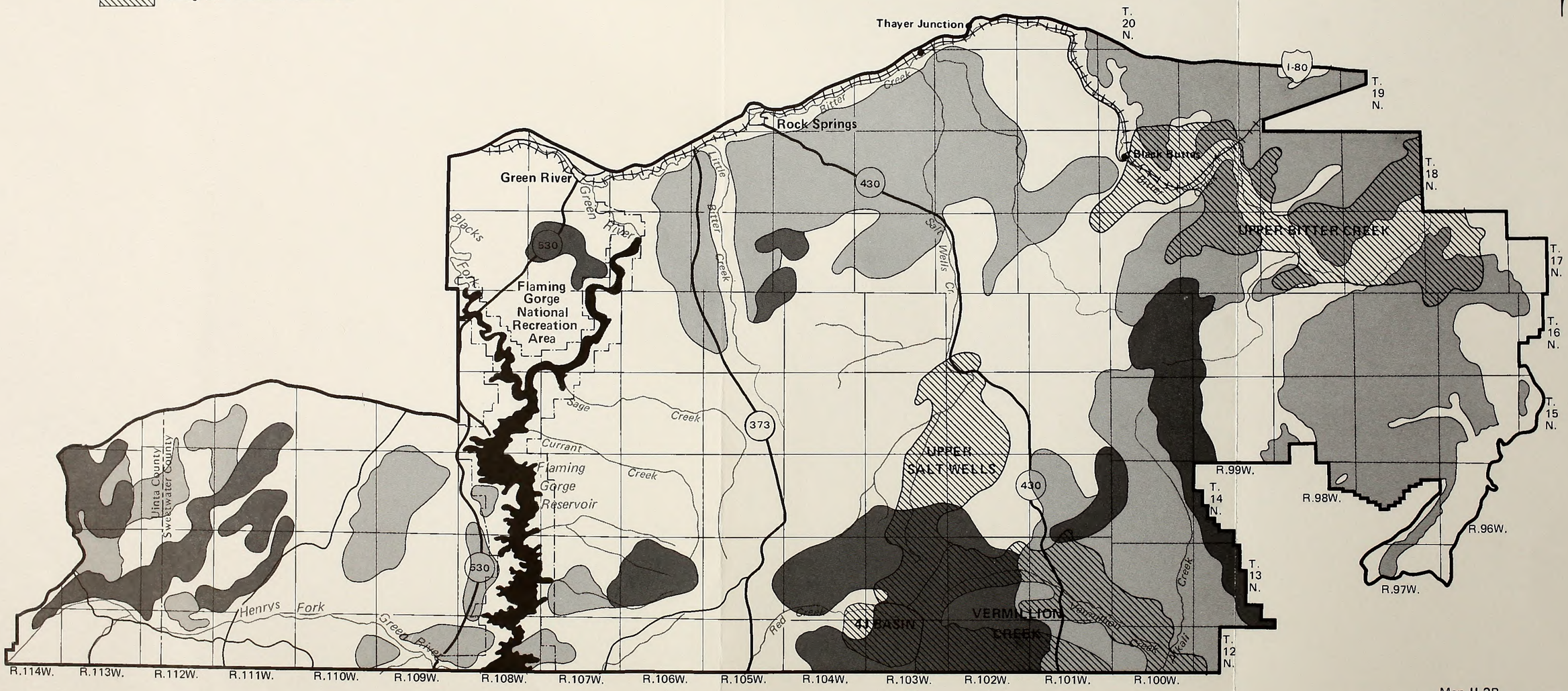
BIG SANDY – SALT WELLS
OIL AND GAS LEASING
ENVIRONMENTAL ASSESSMENT



Areas With High Percentage of Soils With Severe Erosion Susceptibility

Areas With High Percentage of Soils With Landslide Potential

Designated Problem Watersheds



Scale: 1:500,000

10 0 10 20 Miles

10 0 10 20 30 Kilometres

Map II-2B

MANAGEMENT CONSIDERATIONS
SOILS AND WATERSHED

SALT WELLS RESOURCE AREA

BIG SANDY – SALT WELLS
OIL AND GAS LEASING
ENVIRONMENTAL ASSESSMENT

Table II-4

IMPACTS OF OIL AND GAS ACTIVITIES ON SOILS OF THE ASSESSMENT AREA

Activity	Short-Term Impacts	Degree[1/]	Residual Impacts	Degree[1/]
I. Geophysical Exploration	Compaction	X	Compaction	-
II. Exploration and Development				
A. Drilling	Compaction	+	Compaction	-
	Mixing	+	Mixing	+
	Burial	+	Burial	-
	Contamination	X		
	Removal	X		
B. Access Roads	Compaction	+	Compaction	X
	Mixing	+	Mixing	X
	Burial	+	Burial	-
	Contamination	-		
	Removal	+		
III. Production				
A. Additional Drilling & Access Roads	See Development		See Development	
B. Pipelines	Compaction	X	Compaction	-
	Mixing	X	Mixing	X
	Burial	X	Burial	-
	Contamination			
C. Service Roads	Compaction	+	Compaction	+
	Mixing	+	Mixing	+
	Burial	+	Burial	+
	Contamination	-	Contamination	-
	Removal	X	Removal	X
D. Treatment & Storage Facilities	Compaction	+	Compaction	-
	Mixing	X	Mixing	-
	Burial	X	Burial	-
	Contamination	X	Contamination	-
	Removal	X	Removal	-
IV. Rehabilitation	Compaction	-	Mixing	-
	Mixing	-		
	Burial	-		

[1/] - equals negligible.
x equals moderate.
+ equals severe.

Water Resources

Surface Water

The Green River Drainage comprises the majority of the area (85 percent); 3 percent of the area is in the Sweetwater River Drainage; and 12 percent of the area is in the Great Divide Basin, which is a closed basin with no external drainage. The area contains numerous perennial and intermittent tributaries, springs, ponds and playa lakes, and man-made perennial and intermittent reservoirs. The nature and distribution of surface water in the area are described in detail in the URAs.

Surface water produced in the area is primarily from precipitation. Very little flow from springs and seeps reaches the perennial streams. Average precipitation in the area ranges from 7 to 20 inches and is highly variable from year to year. Precipitation, stream flow data, and surface water impoundments are described in the URAs.

The two major factors affecting water quality in the area are sediment (suspended solids) and dissolved solids. Many dissolved solids are first introduced into a body of water as suspended material, often associated with sediment. A combination of physical and chemical processes then change the relationship of the foreign material with the water from one of physical association to one of chemical combination. The primary source of sediment in area waters is upland erosion with additional contributions from stream bank erosion, bank sloughing, stream crossing, and deposition of soil material into the stream or tributaries from construction activities. A certain amount of upland erosion and streambank erosion is natural or at least unrelated to oil and gas activities. The rate of upland erosion and thus sedimentation is influenced by precipitation amounts and patterns, steepness of the landscape, surface texture and structure, erodibility of the soil, the amount of vegetation cover, and other protective surface features such as rock or irregular surface features. The nature of the dissolved materials depends upon the chemical nature of the soil profile and the nature of contaminants introduced (spills, unauthorized dumping, overflowing reserve pits, etc.). Increased erosion will not necessarily impact water quality immediately. Much eroded soil material does not immediately reach perennial waters. It is often deposited in ephemeral drainages where it may remain until a major storm event occurs. Displaced soil material may be intercepted and stabilized by vegetation, physical barriers, or litter and never enter a perennial body of water.

Within the assessment area, nine watersheds totalling 873,945 acres have been identified as requiring special management consideration (Maps II-2A and II-2B, Table II-5). An additional watershed (Red Creek, 67,058 acres) has been recommended for designation as an ACEC. These have all been identified as sources of unacceptable levels of sediment.

Impacts

Geophysical Exploration. When conducted in accordance with present stipulations and accepted practices, exploration will produce no discernible impact on area surface waters.

Exploration and Development. Drill site and access road construction involve extensive disturbance of surface soil with a commensurate opportunity to produce sediment. The present procedure for approval of applications to drill establishes stringent standards with a major emphasis on the protection of live waters. When adhered to, these stipulations ensure protection of water supplies. Noncompliance with stipulations and accidents can produce sedimentation or contamination of ponds, reservoirs, and streams.

Deep wells (those over 15,000 feet deep) require a year or more to complete and involve daily use of access routes during all kinds of weather conditions. Heavy use of roads during wet, muddy seasons forms ruts which concentrate runoff and increase its erosive power.

The reserve pit is another potential source of surface water contamination. In prior years, reserve pit failures were much more common than they are now. BLM has worked extensively with earthwork contractors which has resulted in better construction practices. Failures are almost nonexistent in properly constructed pits. Improperly constructed pits can fail, releasing large quantities of sediment, often containing potentially harmful chemicals. These spills can sometimes reach live waters. Tables II-6 and II-7 show materials that are typically encountered in reserve pits.

Production. Production involves additional drilling and access route construction with all of the potential problems outlined under exploration and development. In addition, pipelines, storage, and treatment facilities are constructed, used, and maintained with the associated surface disturbance. Sediment may reach waters in the same manner as listed above. In the production phase, liquid hydrocarbons and potentially toxic chemicals are transported by pipelines and trucks. Pipelines are occasionally broken, storage tanks sometimes leak, and trucks overturn. The frequency of these incidents is not high and only a small portion of the accidents affect surface water. However, when they do occur the effects are often severe on a localized basis.

Table II-5

DESIGNATED PROBLEM WATERSHED AREAS

Watershed	Acres	Resource Area
Killpecker Creek	106,022	Big Sandy
Pacific Creek/Jack Morrow	76,211	Big Sandy
Dry Sandy Creek	51,296	Big Sandy
18-mile Canyon	247,386	Big Sandy
Upper Green River[1/]	158,080	Big Sandy
Red Creek[2/]	67,058	Salt Wells
4 J Basin	22,344	Salt Wells
Vermillion Creek	44,788	Salt Wells
Upper Bitter Creek	55,943	Salt Wells
Upper Salt Wells	111,875	Salt Wells

1/ Includes Anderson, Delaney, Steed, Bird, and Figure Four Canyons.

2/ Red Creek watershed has been recommended as an Area of Critical Environmental Concern.

Table II-6

PRODUCTS USED IN FRESH WATER DRILLING FLUIDS

Product	Description	Use
Bentonite	Sodium Montmorillonite	Viscosity.
Benex	Vinyl Acetate - Maleic Anhydride Copolymer	Water loss control, solids control.
Bicarbonate of Soda	Sodium Bicarbonate Powder	Treat out calcium.
Lignite	Lignitic Humic Acid Powder	Thinner or dispersant.
Caustic Soda*	Sodium Hydroxide	Treat contaminations and adjust pH range.
Cellex	Sodium Carboxymethyl cellulose	Water loss control.
Cottonseed Hulls	Cottonseed Hulls	Lost circulation material.
Cypan	Sodium Polyacrylate Powder	Water loss control.
Drispac	Polyanionic Cellulose	Water loss control; aids in dropping drilled solids.
Fibertex (Cedar Fiber)	Processed Cane Fibers	Lost circulation material.
Hy-Seal Mud Seal	Shredded Paper	Lost circulation material.
Kwik Seal	Granules, Flakes, and Fibers Combined Mica Cane Fibers	Lost circulation material.
Lime*	Calcium Hydroxide Powder	pH adjustment; treat contaminations.
Mica	Mica Flakes, Fine or Coarse	Lost circulation material.
Dispersant*	Ferrochrome Lignosulfonate	Thinner, dispersant.
Walnut	Walnut Shells (Granular in Size)	Lost circulation material.
Barite	Barium Sulfate	Used to weight up drilling fluids.
Corrosion* Inhibitor	Chromates - Main Ingredient	Reduce or eliminate drill pipe corrosion or embrittlement.

Source: Gerald Freerksen, Geological Survey, Rock Springs, Wyoming, 1978.

*Toxic Classification (all indicated could be considered toxic).

Table II-7

RESERVE PIT ANALYSIS

Tests	T45N R92W* Section 26	T48N R92W* Section 33	T53N R100* Section 14	T47N R93W* Section 27	T46N R101W* Section 8	T27N R119W Section 2	T27N R119W Section 2	T17N R118W** Section 27	T29N R114**	Average Analysis
Sulfates mg/l	8466.6	--	7280.7	--	1000.0	992.0	700.0	--	226.0	3117.6
Chlorides mg/l	191.8	230.2	27.4	323.4	2499.1	913.0	902.0	64.0	50.0	377.9
Bicarbonate mg/l	--	--	--	--	--	782.0	312.0	510.0	130.0	433.5
Carbonate mg/l	--	--	--	--	--	0	0	1.0	0	.3
Calcium mg/l	--	--	--	--	--	70.1	60.1	47.0	13.0	47.6
Magnesium mg/l	--	--	--	--	--	21.9	15.8	3.6	2.0	10.8
Sodium mg/l	--	--	--	--	--	1701.0	1195.0	220.0	200.0	829.0
Chromium mg/l	--	--	--	--	--	5.0	1.0	--	0	2.0
Potassium mg/l	--	121.0	--	639.0	--	30.0	20.0	33.0	4.0	141.2
Oil & Grease mg/l	7.20	2587.0	--	1390.0	39.9	--	--	--	4.6	805.7
Total Dissolved Solids mg/l	4526.0	--	--	--	3840.0	4646.0	1886.0	2860.0	696.0	3076.0
Conductivity millimhos/cm	--	--	--	50.0	--	3600.0	3400.0	1150.0	940.0	1828.0

Note: Data collected by BLM and analyzed by Northwest Analytical Laboratories, Powell, Wyoming.

*From Grass Creek Oil and Gas Leasing EAR (U.S. Department of the Interior, BLM).
**Data collected by BLM and analyzed by Western Wyoming College, Rock Springs, Wyoming.

Rehabilitation. Some rehabilitation practices involve surface disturbance with the potential to produce sediment during the period of activity.

Red Creek Badlands ACEC

An Area of Critical Environmental Concern (ACEC) has been identified to protect the watershed. This area is the Red Creek Badlands which is located approximately 35 miles south of Rock Springs (see Map II-7B) and is approximately 67,058 acres. The area has a very fragile watershed as the soils are highly erodible. This area also serves as crucial wildlife habitat. BLM's management recommendation is to prohibit or strictly control disturbing activities from December 15 to May 15 and during any other prolonged period of muddy conditions. In addition, all surface disturbing activities will be conducted in accordance with the Red Creek Watershed Plan, which is available for review in the Rock Springs District Office.

Ground Water

Ground water resources of the area are highly variable. Important aquifers in the area are identified in the respective URA. Most of the ground water in the assessment area is used for domestic and livestock supplies and is obtained from drilled wells and from springs. In some areas, drilled wells are the only source of water for livestock, but in other areas wells supplement surface supplies. The quality of ground water where most of the oil and gas activity occurs is generally considered fair to poor for domestic use and good to poor for livestock.

Impacts

Aquifers are usually drilled through to reach oil and gas. Possible impacts to ground water from drilling are the mixing of water from different aquifers and the leakage of toxic materials into shallow aquifers. Regulations require that drill hole casing be cemented in place to a depth of at least 150 feet or more (can be as deep as 1,500 feet) if necessary, to prevent mixing of aquifers and contamination by toxic materials. Failures or leaks occur in 0.5% to 1% of the wells drilled (BLM 1980a). Usually the amount of drilling fluid or brackish water that can infiltrate the aquifer(s) is small, although even a small leak can cause severe localized degradation. Percolation of reserve pit water through the soil in improperly constructed pits may lead to degradation of ground water quality.

It is possible that use of well water for drilling or secondary recovery could lower water levels in nearby domestic wells. If a problem develops, it would be resolved by the Wyoming State Engineer based on the water rights precedence.

Water Use for the Oil and Gas Industry

The water needed for drilling operations is usually obtained from streams, privately owned stock reservoirs, or wells. Shallow water wells are commonly drilled for the needed water in the Big Sandy Resource Area. Because water use permits are required by Wyoming law and are issued by the State Engineer's Office, existing water appropriations are protected. The amount of water needed by the oil and gas industry annually in the assessment area is expected to remain constant (see Table II-3). It is anticipated that water used by the oil and gas industry will become a smaller proportion of total use in the assessment area, due to industrial development, particularly mineral-related, and population growth.

Vegetation

The vegetation of the area ranges from salt desert shrubs to coniferous forests. Most of the forested areas within the assessment area are located in the higher precipitation zones (12-20 inches) associated with the Wind River Front, and on Pine and Little Mountains in the Salt Wells Resource Area. Vegetative communities vary, depending upon soil type, precipitation, elevation, exposure, and temperature. Table II-8 shows the major vegetation types and their percentage of the total land area. By far the most abundant species and predominant aspect is sagebrush. (Map II-3 which will depict the vegetation of the assessment area is being developed and will be available when the final edition of this environmental assessment is issued. However, the base information can be reviewed in the BLM Rock Springs District Office.) All federal and most private lands have been inventoried to determine the kind and amount of vegetation present. These inventories are available for inspection in the respective resource area offices.

In the drier precipitation zones (7-9 inches), coniferous and broadleaf species disappear almost entirely except for small isolated and protected areas where a spring, seep, or perennial deep snow area has changed the microclimate. There are several sites within the assessment area where elevation, topography, and climate combine to support more substantial forest stands. These areas include: Oregon Buttes, Pacific Butte, Steamboat Mountain, Zirkel Mesa, Bush Rim, White Mountain, Pine Mountain, Little Mountain, Hickey Mountain, Black Mountain, Pine Butte, and Teepee Mountain. Tree species include: aspen, limber pine, lodgepole pine, subalpine fir, cottonwood, Utah juniper, and smaller stands of Douglas fir and Engelmann spruce.

Table II-8

COMMON VEGETATION TYPES WITHIN THE ASSESSMENT AREA

Type	Percent of Area
Sagebrush	58
Saltbush	13
Greasewood	6
Pinyon-juniper	5
Desert Shrub	4
Broadleaf	2
Conifer	1
Mountain Shrub	2
Half-Shrub	<1
Barren	3
Perennial Forb	2
Meadow	1
Grass	2

Impacts

Geophysical Exploration. When exploration activities are conducted in accordance with standard stipulations and operating procedures, the effect on vegetation is minimal, although exceptions do exist. If a timber stand is too dense to allow drill trucks or exploration trucks to enter, trees may have to be cleared. If blasting occurs within three feet of a tree, it will die, either from being knocked down or through physical damage.

The disturbance and destruction of woody plants (sagebrush, greasewood, etc.) that results from clearing of seismograph trails, snow removal, and passage of heavy equipment can be beneficial. This disturbance sometimes causes a release effect by making additional moisture and nutrients available to understory grasses and forbs. If the trails do not become heavily used, this effect may continue indefinitely. It may even be enhanced by additional snow accumulation, leaving linear discontinuities in the otherwise extensive brush lands.

Exploration and Development. Well site and access road construction results in removal of vegetation, directly in proportion to the amount of surface disturbed. Additional impacts include the smothering or coating of vegetation with dust, and poisoning of vegetation by toxic fumes associated with traffic on roads. Current research indicates that these impacts are temporary in nature at the levels associated with oil and gas activities and therefore minimal.

Well site and access road construction within forested areas results in loss of timber in proportion to the amount of surface disturbance. In addition, those trees bordering a disturbed area will be more susceptible to wind damage. In the drier zones where small stands exist due to the presence of springs or seeps, development of access roads and drill sites will have serious impacts. Surface disturbance within these areas could dry up the water sources, thus causing complete destruction of the stand.

Production. The additional drilling and the construction of pipelines, storage, and treatment facilities necessary to put a field in production, will cause additional surface disturbance and a corresponding loss of vegetation and trees.

Rehabilitation. Generally, rehabilitation has a positive effect on vegetation. Rehabilitation plans usually include revegetation with native or BLM approved introduced species. Appendix E contains a site-specific rehabilitation plan for the assessment area. Rehabilitation usually includes reshaping the disturbed area, topsoil placement, water bar construction, etc. These practices may have typical construction-related impacts on vegetation; however, this is usually limited to areas already disturbed. Previously disturbed vegetation often consists of undesirable invader species which have occupied disturbed areas. Additional disturbance can sometimes occur when a larger area is required to correctly recontour the site. When this occurs, additional native vegetation may be destroyed. The object of revegetation is to mitigate undesirable impacts on livestock, wildlife, soils, vegetation, water quality, aesthetics, etc., caused by surface disturbance. This objective is not always met. Revegetation efforts are considered unsuccessful when:

1. Initial establishment is poor; or

2. Subsequent events cause the revegetated area to decline in density or vigor at a rate greater than adjacent areas; or

3. The stand, even though successful in establishment, does not adequately resume the role that the original stand played in the area.

These conditions usually result from improper species selection, poor seeding practices, or poor followup management. Unusually dry, windy, or cold years can also contribute to unsuccessful revegetation.

Comprehensive data is not available on the success and failure of revegetation efforts in the area. Failures are more apparent than successes. Also, successfully rehabilitated sites have not been documented to the point of being useful to support present practices. On the positive side, BLM has greatly increased the amount of basic resource data available from which recommendations for revegetation can be drawn. Most of the assessment area now has ecological range site data available which could be the bases for more site specific and, therefore, potentially more successful revegetation standards.

General. In all instances where soil is disturbed and native vegetation destroyed, conditions are created which are often favorable for the establishment of invader species (usually noxious weeds) such as halogeton or Russian thistle. These populations then become reservoirs for further invasions of surrounding newly disturbed areas.

Threatened or Endangered Plant Species

The area has been inventoried and all identifiable populations of Large Seeded Bladderpod (*Lesquerella macrocarpa*) and Precocious Milkvetch (*Astragalus proimanthus*) have been recorded. These species have been listed as candidates for proposal as threatened species (*Federal Register*, Volume 45, No. 242, December 15, 1980).

Bureau policy mandates that these plants and their habitat should be protected from disturbance. However, the populations of these plants are small enough so that any well or pipeline proposed for the area could be moved a short distance and avoid impacting the plants.

Wildlife

Wildlife in the assessment area are an integral component of the natural environment, providing a source of food and recreation to the users of public land. Yearlong habitat is provided for a great many species of mammals, birds, reptiles, amphibians, fishes, and invertebrates. Important summer and winter ranges for moose, elk, deer, and pronghorn antelope occur throughout the area. Map II-4 (inside back cover) illustrates those areas considered to be crucial for the continued survival of the wildlife population within the assessment area. These crucial areas include: pronghorn antelope winter range, 632,152 acres; moose winter range, 116,983 acres; mule deer winter range, 632,895 acres; and elk winter range, 477,751 acres. As can be noted from the map, species often share crucial winter range. Considering shared habitat, the total crucial winter habitat in the assessment area is 1,586,924 acres or 28 percent of the area. In addition, 941,031 acres are crucial sage grouse strutting and nesting habitat, and 36,710 acres are crucial elk calving areas.

Large predators, such as mountain lions, bobcats, coyotes, swift foxes, and red foxes also inhabit the area. An abundance of small mammals, including cottontail rabbits, jackrabbits, white-tailed prairie dogs, ground squirrels, and others, provide a large prey base for raptors in the area. Numerous cliffs and rims provide nesting habitat for raptors such as prairie falcons, ferruginous hawks, golden eagles, great horned owls, red-tailed hawks, and kestrels. Map II-5 (inside back cover) illustrates important raptor habitat in the assessment area. Cutthroat trout, rainbow trout, brook trout, and brown trout, to name a few, inhabit the area's waterways. Complete species lists for the Big Sandy and Salt Wells resource areas are available in the Rock Springs District Office and a species list for the Rawlins portion of the Adobe Town Wilderness Study Area is available in the Rawlins District Office.

Impacts

Major conflicts exist between the oil and gas program and wildlife. Because of the vast number of wildlife species that inhabit the area, it is impossible in a document of this scope, to examine the effects of oil and gas activity as they relate to each species. However, some species are restricted to a specialized or uncommon habitat, and it is those species which are significantly affected by disturbances in their habitat. Examples of these are elk, raptors, and some game birds.

BLM has developed lease stipulations which serve to minimize the detrimental effects of the oil and gas program on wildlife. Unfortunately, lack of enforcement of these special stipulations can sometimes render these efforts ineffective.

In the sections that follow, impacts of oil and gas development on wildlife are discussed in relation to the various phases of the oil and gas program. In many cases, those effects are not easily quantifiable. Although quantification of the impacts of oil and gas activity is lacking, the essential habitat components necessary for healthy wildlife populations have been identified. Therefore, by protecting key areas through development and enforcement of special stipulations, the wildlife resource can be protected.

Geophysical Exploration. Geophysical exploration has the potential of causing serious adverse impacts to wildlife. It is generally viewed that because seismograph lines can be run within a relatively short timeframe, their impacts on wildlife are minimal, and at worst, cause temporary disturbance.

Knight (1980) studied the effects of seismic exploration on elk in northern Michigan. He concluded that elk were alarmed, and moved in response to seismic activity. In Knight's study over 90 percent of the area was forested, hence escape cover was probably not limiting. In the assessment area, where escape cover is a limiting factor, the effects of seismic exploration on elk are much more dramatic. During periods when natural stress factors are low (e.g., July 1 to December 15), the movement of elk away from a seismograph line is not critical. However, during the winter and calving season, when the natural stress factors are at a maximum, seismic activity can cause movement away from crucial habitat, and have very detrimental effects on the elk populations.

BLM's biologists have observed that although other big game species (moose, deer, and antelope) are not as sensitive as elk to seismic activity, they do exhibit similar responses. Once again, the critical periods are during the winter and fawning/calving seasons, when natural stress factors are high.

Disturbance to big game during the critical periods of winter and spring can be severe. Using elk as an example, it has been shown that several fac-

tors, resulting from displacement (due to seismic activity), interact to affect population numbers and quality of animals within a population. Calves may be abandoned or lost to predators at a higher rate if they are forced to travel to areas of minimal disturbance when only a few days old (Johnson and Lockman 1981). In the first four to five days after birth, a calf's ability to travel is restricted; however, when encouraged by the cow to travel to areas of nondisturbance, a calf is exposed to increased levels of predation, pneumonia, and accidents (Johnson and Lockman 1981). Animals will not grow as fast or mature as early if forced from a diet of high quality forage to a diet of lower quality. The importance of succulent forage to a lactating cow is well documented. Competition between species for high quality forage can increase if animals are concentrated onto unaffected sites because of disturbance. The end result will be fewer animals or smaller animals with less body fat in fall, thus decreasing survival during winter. There is relatively little "spare energy" an animal could expend in summer without running an energy deficit. In the winter ungulates (a hoofed animal) are in a negative energy balance and disturbance increases the energy deficit.

It has been shown that conducting geophysical exploration near nesting, or wintering raptors can have serious adverse impacts. Besides actual destruction of a nest, Call (1979) concluded that seismic lines may disrupt nesting, which could cause: abandonment of nests; missed feedings of young with subsequent mortality of young; and complete abandonment of territory. Seismic operations conducted in winter may also cause bald eagles or other raptors to abandon historical roosts or force them away from important feeding areas.

Raptors are very sensitive to human disturbance. A single human visit to the vicinity of the nest of many species may cause desertion of the nest site, particularly if done early in the nesting cycle (Chihuahuan Desert Research Institute 1976).

Sage grouse are the most common upland game bird in the assessment area. These birds conduct their mating activities on the same lek (strutting ground) every year. It is estimated that 68 percent of sage grouse nesting occurs within 1.5 miles of the lek (Wallstead 1975). As these birds are persistent in their use of the same lek year after year, seismic activity will not affect them as much as would be expected (pers. comm., Mayo Call 1981). However, the creation of two-track trails by seismic lines increases vehicle access. Except during the mating season from March 1 to May 15, the major impact of geophysical exploration is caused by the increased access and the resultant increase in poaching incidents. The birds' tendency to concentrate in leks makes them highly vulnerable to poaching.

Overall adverse impacts of exploration on the fishes in the assessment area is probably insignificant. Contamination/disturbance of aquifers could degrade water quality in spring fed streams, and impact the fisheries resource. Discussions of these impacts are found in the water quality section.

In summary, geophysical exploration impacts wildlife in two ways: (1) disturbance and (2) increased incidence of poaching.

Exploration and Development. Drilling for oil and gas has many of the same impacts on wildlife as geophysical exploration. Generally speaking, these impacts tend to be more serious due to: (1) greater amounts of surface disturbance; (2) longer periods of human disturbance; and (3) better vehicular access to the drill site.

Johnson and Lockman (1981) studied the effects of drilling on elk in Snider Basin, Wyoming. They concluded that disturbance due to drilling affects elk by: (1) increasing mortality in calves; (2) delaying maturity; (3) decreasing body size of adults; and (4) reducing body fat reserves, thus reducing survival in winter. The impacts of surface disturbance are also compounded by reducing types of forage which cannot be replaced by rehabilitation efforts. Although elk are the most sensitive to disturbance, these conclusions can be applied to all big game occurring in the assessment area.

The greatest single adverse impact of oil and gas activity within big game habitat results from constructing and upgrading access roads. This exposes escape cover and feeding areas that were formerly sanctuaries. Two studies in Idaho indicated that vehicular access into previously undisturbed habitat resulted in a higher hunter harvest and led to long-term declines in elk populations (Thiessen 1976, Leege 1974). Even in pronghorn antelope, which exhibit a high degree of adaptability to oil and gas development, increased access will, at best, lead to an increase in poaching losses.

In addition to the impacts previously identified in the exploration section, raptors may be impacted by development activities. Primary problems associated with well development include: (1) destruction of primary feeding areas; (2) influx of personnel into the area, causing adverse impacts due to their recreational use of surrounding areas; (3) frequent indifference of personnel to protected wildlife and their habitat; and (4) destruction of important roosting habitat.

Because the impacts due to geophysical exploration are all applicable to the development phase, with regard to raptors; it is evident that drilling oper-

ations, due to prolonged periods of human presence, pose the most serious threat to the well being of the raptor populations.

The major impacts caused by oil and gas activities on sage grouse is related to surface disturbance and increased vehicular access. Surface disturbance within an historical lek can have disastrous effects. In one case a paved road was constructed over a lek. The following year the sage grouse continued their strutting in the middle of the road (pers. comm., James D. Dunder 1981) and were killed by passing cars. Because the lek site is so strongly imprinted in the birds, surface disturbance within the area can only serve to diminish the population. Increased vehicular access, as pointed out in the exploration impacts section, makes these birds more vulnerable to poaching. Noise from drilling operations can have a disruptive affect on strutting activity if the noise overpowers the sound of the sage grouse "booming."

The impacts of development on fish result from increased silt loads in streams and reservoirs. This would reduce light penetration which, in turn, would cut productivity of aquatic plants. Aquatic plants could be scoured from their substrate by excessive silt loads. This would reduce invertebrate populations. Increased silt loads in streams would clog spawning gravels and suffocate eggs of trout and other gravel spawning fish, leading to reduced populations.

Oil spills, and spills of other contaminants, would have direct toxic effects on fish and aquatic invertebrates. The entire food chain would be disrupted, and the effects of an oil spill into a stream would be long term. These impacts are not quantifiable, and the significance of the damage would depend on the size of the spill.

Production. The major impacts to wildlife, during the production phase of the oil and gas program, are caused by pipeline construction and human presence. This activity results in human disturbance, surface disturbance, and increased access. All three of these elements are covered in the preceding sections, but the adverse effects are compounded by the increased duration of the disturbance.

After the construction of powerlines, which occurs during the production phase, electrocution of raptors could occur. However, modern powerline design has, for the most part, eliminated this hazard. Raptors could collide with powerlines posing a hazard.

Abandonment. Abandonment of an oil and gas well site benefits wildlife. Abandonment of a well site removes the adverse impacts resulting from human disturbance. Those impacts resulting from surface disturbance (i.e., drill pad construction) and increased public access (i.e., access road construction) will remain until the site is successfully reclaimed.

Rehabilitation. Revegetation of abandoned drill pads and roads with grass species where sagebrush is the predominant species, creates openings in the habitat and increases the amount of "edge" between habitat types. Increasing the amount of edge increases the number of individuals and the diversity of wildlife in the area, because the edge will attract species who favor either habitat type.

Pine Butte ACEC

An Area of Critical Environmental Concern has been identified to protect important raptor habitat which has potential as peregrine falcon habitat (see Map II-7B). Pine Butte is located approximately 30 miles southeast of Rock Springs and contains approximately 440 acres. BLM's management recommendation is to not allow disturbing activities from March 1 to July 1. No new roads or utility corridors to the site would be allowed if they would damage the cliff or infringe upon the nesting/roosting sites.

Threatened and Endangered Species

Section 7 of the Endangered Species Act requires the Bureau to manage habitat for protection of species in danger of extinction, to ensure their conservation, and to consult with the Fish and Wildlife Service (FWS) on any action which results in a "may affect" decision. The FWS has determined that the following officially listed species may be present in the assessment area: bald eagle (*Haliaeetus leucocephalus*), peregrine falcon (*Falco peregrinus*), black-footed ferret (*Mustela nigripes*), bonytail chub (*Gila elegans*), humpback chub (*Gila cypha*), and the Colorado squawfish (*Ptychocheilus lucius*).

Bald eagles are common to the project area during the winter and migration periods. No bald eagle nesting sites have been located in the area although potential for nesting opportunity exists along the Green River and Flaming Gorge Reservoir. Areas along the Sweetwater and Big Sandy rivers are also suitable. Most of the winter use of the area by bald eagles is contained along the Green River. No communal roosting sites have been identified with the early winter use which is fairly evenly distributed along the river. Alan Jenkins (pers. comm., 1980) indicated that in late

winter the majority of bald eagle use was found to be in the ice free areas below Fontenelle Reservoir. Because of scattered distributions along the Green, significant impacts to bald eagles would not be expected. This random pattern of eagle distribution would probably allow for the easy availability of alternate sites for any eagle displaced by oil and gas activity.

Surveys to determine the distribution and status of the peregrine falcon in Wyoming have been conducted by the FWS. Surveys have failed to locate nesting peregrines in the assessment area. Data have shown that four historical nesting sites are known within the Rock Springs District and this information is sufficient to conclude that fair potential exists for peregrines to both winter and nest in the district. If active or wintering concentrations are discovered in the future, consultation with FWS will be initiated to determine essential habitat.

Potential habitat for black-footed ferrets (white-tailed prairie dog towns) exists throughout the assessment area. Surveys in coal occurrence areas within the assessment area conducted by the FWS, failed to identify any presence of black-footed ferrets. Section 7 of the Endangered Species Act does require that areas of potential black-footed ferret habitat be investigated for the presence of the species before agency actions disturbing such habitat take place. The following procedures should be carried out pursuant to Section 7(a)(1) of the Endangered Species Act:

1. Destruction of prairie dog towns should be avoided as much as possible.

2. All prairie dog towns that will be affected by construction activities must be surveyed for ferrets. If ferrets are located during these surveys or at any time during the construction or life of the project, formal consultation with the FWS should be initiated immediately.

The Colorado squawfish, humpback chub, and bonytail chub are regarded as having historical distribution in Wyoming. However, their existence has not been verified within the assessment area. A fisheries distribution and species composition inventory was conducted in the Rock Springs District by Bio/West Incorporated in 1978 and 1981. They concluded the humpback chub, Colorado squawfish, and bonytail chub are probably extinct in Wyoming. None of these species were found in any of the streams surveyed by Bio/West. The likelihood of oil and gas activity adversely affecting the aforementioned species seems remote.

Livestock Grazing

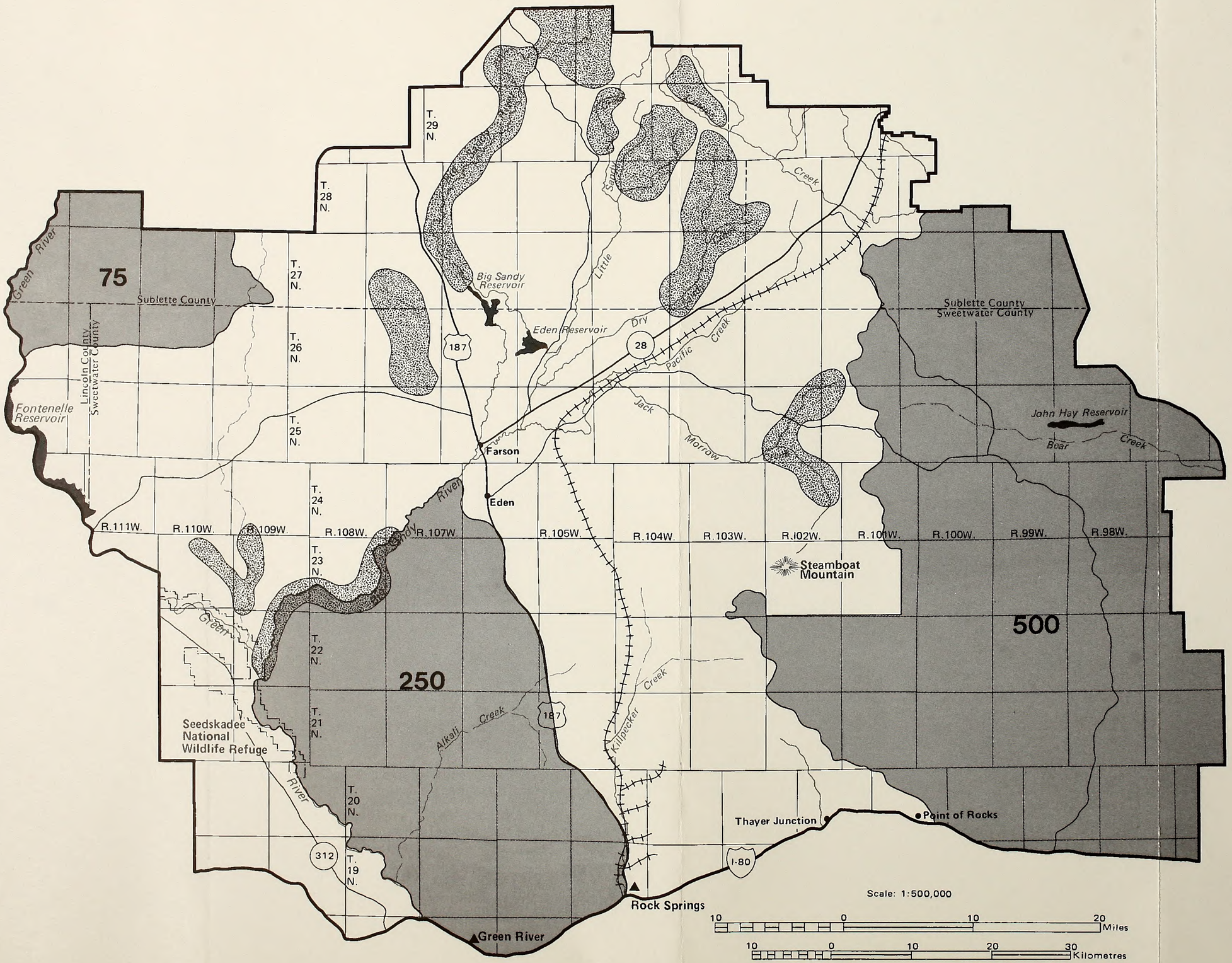
All of the assessment area is important for livestock grazing. The area is primarily utilized by cattle and sheep. Most of this use is on a year-round basis. There are 91 livestock operators within the assessment area which are currently utilizing approximately 187,000 animal unit months (AUMs--see Glossary) for their livestock. Since one of the primary uses of vegetation is for livestock forage, loss of vegetation due to disturbance results in a loss of AUMs available for livestock use. Approximately 12 acres are required to produce one AUM. Therefore, approximately 85 AUMs are lost each year to oil and gas development. However, this AUM loss is distributed throughout the assessment area and the loss of forage has typically not resulted in reductions in authorized grazing use.

Impacts

Geophysical Exploration. Seismograph trails can result in both increased or decreased forage, depending on subsequent events not usually related to oil and gas development (see Vegetation). In large expanses of dense sagebrush or other vegetation types having a restrictive effect on livestock and human movement, seismic trails can enhance livestock movement and management. This can also increase livestock harassment by recreationists and encourage unwanted drifting by livestock in areas without fenced boundaries.

The appearance of seismic crews with the attendant activity and noise can frighten livestock. This can cause drifting of livestock from customary use areas, temporary weight loss, and abandonment "bumming" of young animals. An abandoned calf or lamb may die or suffer permanent weight loss. These impacts are generally rare or difficult to document. One particular area of concern is the effect of disturbance on range lambing operations. The newborn lamb is among the most fragile and vulnerable of creatures; most ewes have a high tendency to abandon their lambs when disturbed during the first few days of the lamb's life. Unexpected noise (seismic shot charges, helicopters, trucks, etc.) often result in separation of ewe and lamb, with death of the lamb the usual result. Maps II-6A and II-6B illustrate the lambing areas. These areas comprise 281,836 acres which is approximately 5 percent of the assessment area.

Exploration and Development. Drilling can cause temporary disturbance to animals. The heavy truck traffic to and from a drill site can increase accidental death of livestock. Livestock theft often increases in areas of increased human activity asso-



Map II-6A

MANAGEMENT CONSIDERATIONS RANGE LAMBING AND WILD HORSES BIG SANDY RESOURCE AREA

BIG SANDY – SALT WELLS
OIL AND GAS LEASING
ENVIRONMENTAL ASSESSMENT

Wild Horse Area

50 Proposed Wild Horse Populations

Range Lambing Area

N

Thayer Junction

Rock Springs

Green River

Black Buttes

Flaming Gorge National Recreation Area

Flaming Gorge Reservoir

Uinta County

Sweetwater County

100

50

50

200

50

I-80

430

530

373

Bitter Creek

Little Bitter Creek

Salt Wells Cr.

Green River

Blacks Fork

Sage Creek

Current Creek

Henrys Fork

Green River

Red Creek

Vermillion Creek

Alkali

T. 20 N.

T. 19 N.

T. 18 N.

T. 17 N.

T. 16 N.

T. 15 N.

T. 14 N.

T. 13 N.

T. 12 N.

R.114W. R.113W. R.112W. R.111W. R.110W. R.109W. R.108W. R.107W. R.106W. R.105W. R.104W. R.103W. R.102W. R.101W. R.100W.

R.99W. R.98W. R.97W. R.96W.

Scale: 1:500,000

10 0 10 20 Miles

10 0 10 20 30 Kilometres

Map II-6B

MANAGEMENT CONSIDERATIONS
RANGE LAMBING AND WILD HORSES

SALT WELLS RESOURCE AREA

BIG SANDY – SALT WELLS
OIL AND GAS LEASING
ENVIRONMENTAL ASSESSMENT

ciated with oil and gas development. Animals can be poisoned or trapped in improperly fenced mud and waste pits.

New access roads can enhance livestock management. Development activities sometimes provide new sources of water for livestock use.

Production. Impacts associated with development continue and increase. The increase in all-weather roads can enhance livestock management. Opportunities for livestock loss due to accidents and theft increases proportionately with the scale of development. The presence of steady, high-paying energy jobs puts ranchers at a disadvantage when competing for available labor. Increases in population and changes in land use put upward pressures on land prices. While this can provide new, lucrative markets for land, it also increases the pressure for conversion of agricultural land to other uses and increases the cost of acquiring or keeping agricultural land.

Abandonment and Rehabilitation. Most beneficial impacts (access, water) are retained. Most adverse impacts (hazards, human presence) are reduced or eliminated. Successful reclamation can result in increased and improved forage.

Wild Horses

The assessment area contains a large population of wild and free-roaming horses. Horses occupy most of the area at one time of the year or another. Present numbers are in excess of those recommended for management and a herd reduction program is under way. The adoption of wild horse management plans and successful completion of the herd reduction program will result in the approximate numbers and use areas shown on Maps II-6A and II-6B. These use areas comprise approximately 1.7 million acres.

Impacts

Geophysical Exploration. The passage of exploration vehicles briefly disturbs individual animals. Use of helicopters or explosives would increase the level of trauma. The sudden introduction of a loud noise or uncustomary intrusion could frighten mares heavy with foal or mares with new foals, causing occasional abortions or abandonments. Such occurrences are undocumented. Frightened animals do flee across roads and may be struck by passing vehicles.

Exploration and Development. Activities associated with construction and drilling will temporarily displace horses from accustomed ranges. Horses in the area usually return to customary use areas if alternate water and forage are not available.

Production. Increased activity and vegetation destruction decreases available forage and increases wildlife/wild horse conflicts in areas remote from human presence. Where production facilities do not become too concentrated, horses appear to adjust to human presence if alternative habitat is not available. As traffic increases, road kills increase proportionately.

Rehabilitation. Horses are not usually affected by rehabilitation requirements but have been observed to damage new seedings.

General. New roads and increased human activity increase opportunities for private citizens to view wild horses. If the points of contact are not critical habitat areas, horses will be displaced to other areas. When such relocation is not possible, the horses become accustomed to human presence to the point that they lose much of their wild nature, even becoming public nuisances. Such was the case in an area immediately adjacent to the assessment area (LaBarge field). The horses were unable to escape to other habitat and were finally removed when they began to enter private yards, parks, school yards, etc., destroying lawns and shrubs.

Recreation

Recreational pursuits in the area are mostly dispersed, with emphasis on individual activities such as hunting, fishing, camping, hiking, rockhounding, cross-country skiing, snowmobiling, and "four-wheeling."

Impacts from oil and gas activities can be beneficial or detrimental, depending upon the recreational activity, and affect the whole spectrum of recreation. The various recreational activities can be grouped into two broad categories: access oriented and solitude oriented. Access oriented activities consist of "four-wheeling," dirt biking, snowmobiling, etc. Solitude oriented activities consist of hiking, bird watching, cross-country skiing, etc. Other activities, such as hunting and fishing, taken at face value, can fall into either category, depending on the user and his/her recreational objective. In the narrative that follows, impacts of the various stages of the oil and gas program will be identified with regard to the two categories of recreation.

Impacts

Geophysical Exploration. The effects of exploration on all types of recreation are minimal. Noise disturbance will affect all recreationists to some degree; but, as seismograph crews move rapidly, disturbance in any one area only occurs for a day or two.

Increased access which can result from seismic exploration, opens up previously inaccessible areas to those recreationists that are "access oriented." Increased access can be particularly beneficial to hunters. However, in areas where adequate access already exists, increased access may be detrimental to the quality of the hunt. On the other hand, to "solitude oriented" recreationists, increased access, and hence traffic and associated noise, detracts from the quality of their experience.

Exploration and Development. Drilling for oil and gas impacts all types of recreation. Prolonged periods of noise, long-term visual intrusions, and odors reduce the quality of the recreational experience. Within oil fields, hazards such as noxious fumes, heavy equipment, and potentially hazardous chemicals are present. At the extreme, these factors could eliminate a site as a possible recreation area.

Access roads constructed for drill sites impact recreationists the same way as seismograph trails. However, even "access oriented" recreationists may have their experience degraded, once the end of the road is reached. The "access oriented" hunter who uses a well site road may find no animals to hunt, due to the displacement of animals by oil field activity.

As more jobs are created by oil and gas activity, the number of people using an area for recreation, increases. This increased use can detract from the quality of a recreation experience for many recreation activities.

Production. Impacts to the recreationist, during the production phase of oil and gas activities are caused by pipeline construction and installation of production facilities such as storage tanks. Construction of pipelines and facilities provides increased vehicular access, noise pollution, and visual intrusions. During construction, pipelines may create a temporary barrier to off-road travel and could pose a temporary hazard to recreationists.

Abandonment. Granting that the impacts caused by oil and gas activities from the exploration phase through the production phase, have already occurred; abandonment improves the recreational experience. "Access oriented" recreationists will be able to use the roads already constructed. "Solitude oriented" recreationists will be able to enjoy areas which were once filled with oil field equipment and have now been returned to a more natural environment.

Rehabilitation. Reclamation of abandoned drill pads and access roads can only serve to enhance the experience for the "solitude oriented" recreationist. Loss of roads, due to rehabilitation, may disturb the "access oriented" recreationist. However, if the road is used frequently, the road may not respond to rehabilitation efforts, and will constitute a residual impact.

Greater Sand Dunes ACEC

An Area of Critical Environmental Concern has been identified to protect the values found in the Greater Sand Dunes. This area is located approximately 30 miles north of Rock Springs and contains approximately 38,480 acres (Map II-7A). It is a natural recreation area, having highly scenic values. It also contains cultural resources, serves as important habitat for a desert elk herd, and is a unique natural system. BLM's management recommendations include restricting mineral development, limiting access for off-road vehicles, and possible establishment of patrols to protect the cultural values.

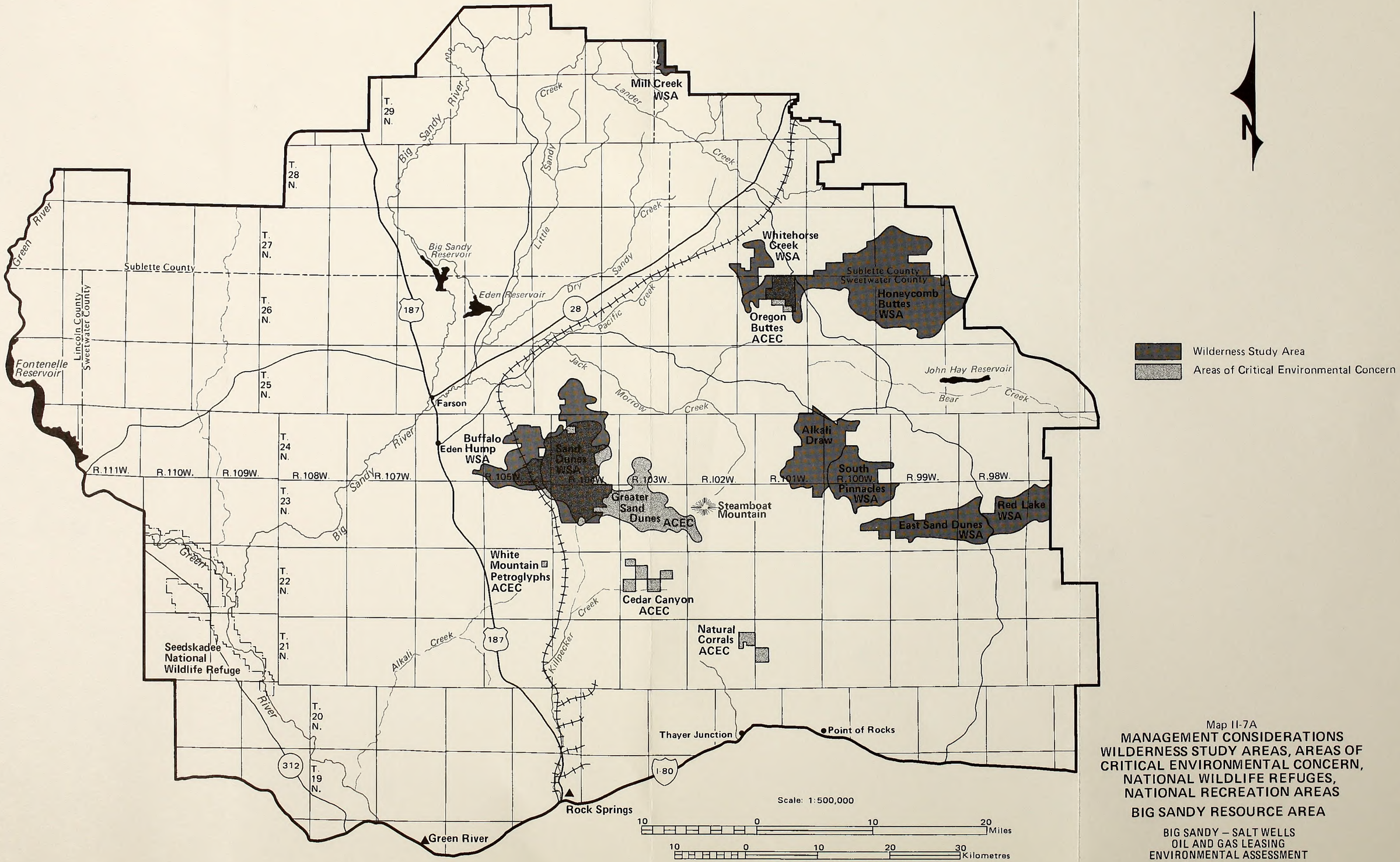
Wilderness

The Federal Land Policy and Management Act of 1976 (Public Law 94-579) or FLPMA, is Congress' basic guidance to the Bureau on how to manage the public lands under its jurisdiction. Section 603 of that law directs the Bureau to (1) review all public land roadless areas of 5,000 acres or more having wilderness characteristics; (2) determine their suitability or nonsuitability for wilderness designation; and (3) report these suitability recommendations to the President no later than October 21, 1991. The President must then report his final recommendations to Congress within two years and Congress will decide if any area becomes wilderness or not.

There are presently 14 areas within the assessment area which have been inventoried by BLM and designated as Wilderness Study Areas (WSAs) (see Maps II-7A and II-7B). The WSAs and the affected acreages are listed on Table II-9.

As a result of these areas' designation as WSAs, they are managed under BLM's *Interim Management Policy and Guidelines for Lands Under Wilderness Review* (December 1979).

Under these guidelines geophysical exploration within WSAs may be allowed as long as no notice-

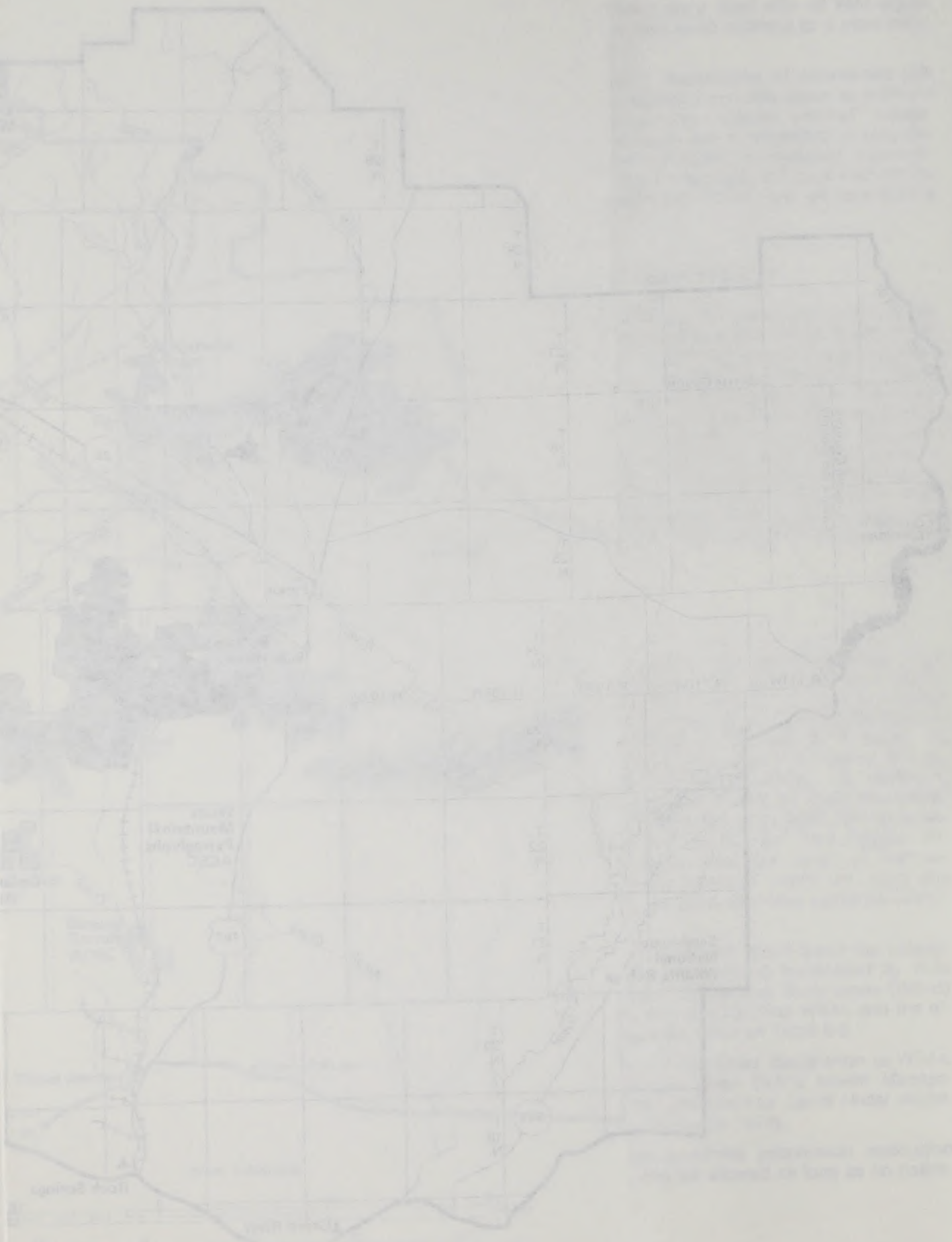


Map II-7A

MANAGEMENT CONSIDERATIONS WILDERNESS STUDY AREAS, AREAS OF CRITICAL ENVIRONMENTAL CONCERN, NATIONAL WILDLIFE REFUGES, NATIONAL RECREATION AREAS

BIG SANDY RESOURCE AREA

BIG SANDY – SALT WELLS
OIL AND GAS LEASING
ENVIRONMENTAL ASSESSMENT



Wilderness Study Area

Proposed Area of Critical Environmental Concern

N

Thayer Junction

Rock Springs

Green River

Black Buttes

Flaming Gorge National Recreation Area

Pine Butte ACEC

Adobe Town WSA

Devils Playground WSA

Pine Springs ACEC

Twin Buttes WSA

Red Creek Badlands ACEC

Red Creek WSA

I-80

430

530

373

Bitter Creek

Little Bitter Creek

Salt Wells Cr.

Blacks Fork

Green River

Sage Creek

Currant Creek

Flaming Gorge Reservoir

Henrys Fork

Green River

Vermillion Creek

Alkali Creek

Uinta County
Sweetwater County

T. 20 N.
T. 19 N.
T. 18 N.
T. 17 N.
T. 16 N.
T. 15 N.
T. 14 N.
T. 13 N.
T. 12 N.

R.114W. R.113W. R.112W. R.111W. R.110W. R.109W. R.108W. R.107W. R.106W. R.105W. R.104W. R.103W. R.102W. R.101W. R.100W. R.99W. R.98W. R.97W. R.96W.

Scale: 1:500,000

10 0 10 20 Miles

10 0 10 20 30 Kilometres

Map II-7B

MANAGEMENT CONSIDERATIONS WILDERNESS STUDY AREAS, AREAS OF CRITICAL ENVIRONMENTAL CONCERN, NATIONAL WILDLIFE REFUGES, NATIONAL RECREATION AREAS

SALT WELLS RESOURCE AREA

BIG SANDY – SALT WELLS
OIL AND GAS LEASING
ENVIRONMENTAL ASSESSMENT

Table II-9

WILDERNESS STUDY AREAS WITHIN THE ASSESSMENT AREA

WSA	Number	Acreage	County	Resource Area
Buffalo Hump	WY-040-306	10,300	Sweetwater	Big Sandy
Sand Dunes	WY-040-307	27,200	Sweetwater	Big Sandy
Alkali Draw	WY-040-311	16,990	Sweetwater	Big Sandy
South Pinnacles	WY-040-313	10,826	Sweetwater	Big Sandy
Alkali Basin-East Sand Dunes	WY-040-316, 317	12,800	Sweetwater	Big Sandy
Red Lake	WY-040-318	9,515	Sweetwater	Big Sandy
Honeycomb Buttes	WY-040-323	41,620	Sweetwater	Big Sandy
Oregon Buttes	WY-040-324	5,700	Sweetwater	Big Sandy
Whitehorse Creek	WY-040-325	4,028	Fremont	Big Sandy
Mill Creek	WY-040-335	1,300	Sublette	Big Sandy
Devils Playground-Twin Buttes	WY-040-401, 402	24,276	Sweetwater	Salt Wells
Red Creek Badlands	WY-040-406, 407, 410	8,020	Sweetwater	Salt Wells
Adobe Town[1/]	WY-040-408	85,710	Sweetwater	Salt Wells
Total Acres		258,285		

1/ Includes that portion of the Adobe Town Wilderness Study Area in the BLM Rawlins District (33,000 acres).

able disturbance occurs. If geophysical exploration indicates oil and gas may be present within a WSA in commercial quantities, energy companies will want to develop the resources. If leases had been issued within the study areas prior to passage of FLPMA, then oil and gas activity must be allowed. Development of the oil and gas resource in a WSA could result in destruction of the wilderness characteristics. If this happened, the area would no longer qualify as a WSA, since it would be compromised and it would not be considered by the President or Congress for wilderness status.

Cultural Resources

Cultural resources is a general term used to describe all evidence of man's activity. Cultural resources include artifacts (objects made or modified by man), structures, areas of habitation, works of art, natural features that were of importance in human events, and areas where significant human events occurred even though evidence of the event no longer remains.

For convenience, cultural resources are recognized as discrete areas called sites. Cultural resources are located upon the land surface and within the subsurface soil zones. Cultural resource sites are finite in number and cannot be replaced.

Cultural evidence in the area dates back 10,000 years. Throughout the continuum from this early time until the historic tribes were defeated by the army in the late 19th century, Indians left evidence of their presence. This evidence is manifested in campsites, animal kill sites, rock art panels, stone circles, firepits, tool stone quarries, religious areas, and special use areas for vegetal food processing or animal butchering. Sometimes these sites are easily recognized—stone circles, for example. In other sites, artifacts are widely dispersed and assume a very low visibility.

European contact with the indigenous tribes is believed to have occurred in the mid-18th century. Subsequent exploration by trappers, homesteaders, military groups, miners, and ranchers, led to the presence of military forts, trails, homesteads, mines, trading posts, and battlefields. Maps II-8A and II-8B illustrate the historic trails in the assessment area.

All cultural resource values do not have the same importance. Cultural sites are evaluated regarding their significance. For our purposes, significance is related in two ways. First, the Interior Department rates sites to determine their potential for inclusion on the National Register of Historic Places. (The National Register of Historic Places is a listing of those sites deemed worthy of national recognition and management.) If a site embodies a distinctive characteristic of a type period, method of construction, represents work of a master, or possesses high artistic value, it would be regarded as significant. The second method of significance assignment addresses research potential. If a site possesses attributes that can answer specific questions or fill gaps in our current knowledge, then a judgment of value can be made.

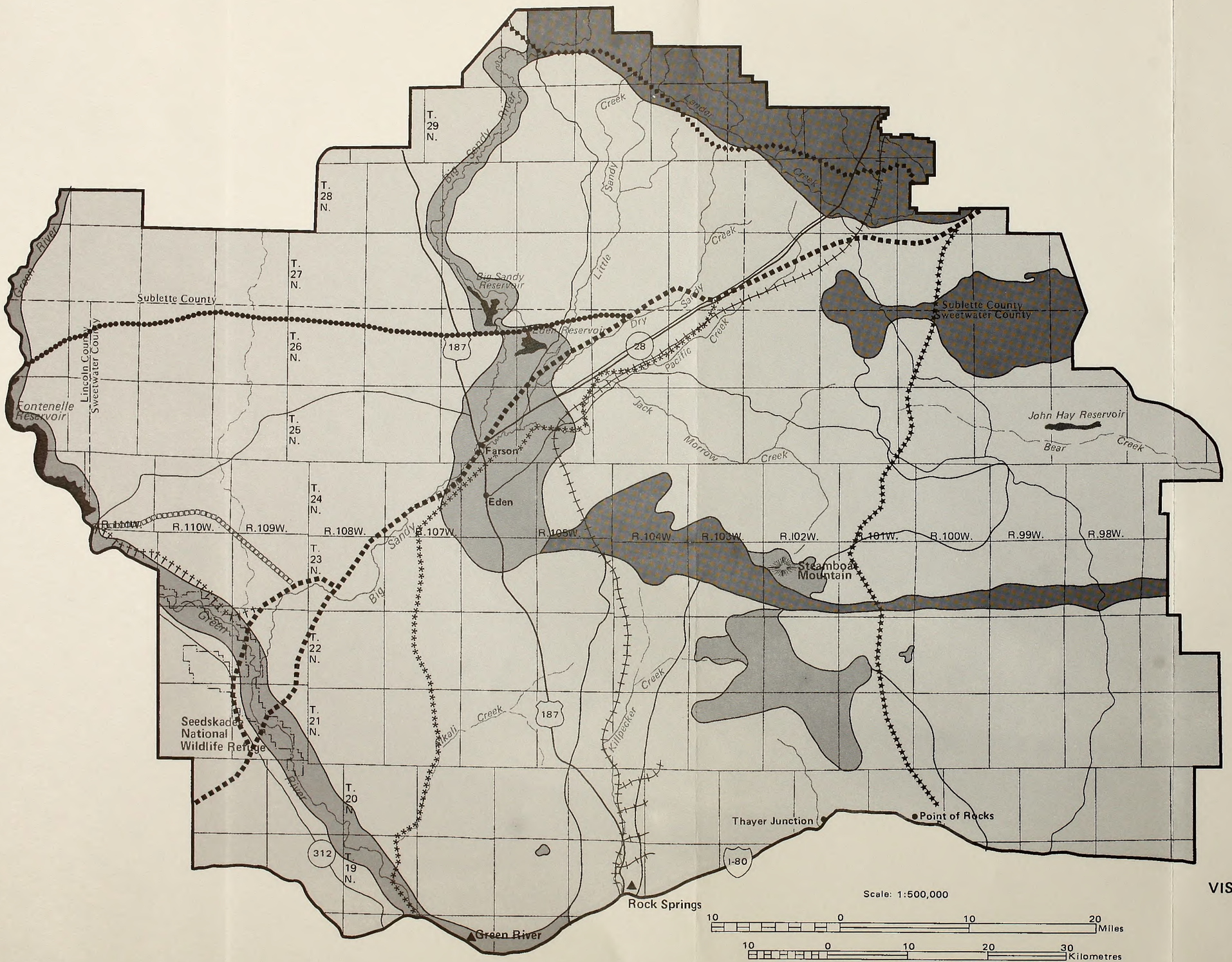
Impacts

Vehicle travel across and excavations into the soil for construction causes "primary" impact or direct destruction of cultural values. Collection of artifacts and vandalism of structures and rock art, brought about by the presence of individuals in areas of oil and gas operations, are "secondary" impacts. BLM has identified six impacts to cultural resources resulting from development of oil and gas resources. Two of these impacts are beneficial in character.

Impact No. 1 (adverse) is the disturbance of site features, crushing of artifacts, and compression and displacement of near-surface deposits. It occurs during geophysical exploration, transportation of equipment, and surveying of locations and rights-of-way. Approximately 356 acres are disturbed annually by seismic activities on federal oil and gas estate within the assessment area. Modern seismic exploration methods make this disturbance limited and temporary in nature. Additional surface disturbance results from support vehicles which travel off planned seismic lines. There is a remote possibility that shot holes for seismic exploration could be drilled through buried sites. The impact continues after seismic work or surveying is complete, because the presence of trails encourages off-road vehicle travel by hunters and other recreationists.

Impact No. 2 (adverse) is the removal of artifacts and hence the loss of information. It is a continuous problem of major consequence with a long-term effect upon the resources. It is recognized that some people cannot resist the temptation to collect Indian artifacts or pick up and examine cultural evidence when encountered. If people constructing a well location are the first to work in a remote area, they have the opportunity to collect previously undisturbed cultural resources. The impact continues after abandonment, because increased ease of access allows the general public to reach previously inaccessible places.

Impact No. 3, protection of National Register quality sites, is beneficial in character. This impact does not occur until the predrilling period when an



N

- Class A Scenic Quality Rating
- Class B Scenic Quality Rating
- Class C Scenic Quality Rating
- Sublette Cutoff
- Emigrant Trail
- Slate Creek Cutoff
- Kinney Cutoff
- Lander Cutoff
- South Pass-Point of Rocks Stage Road
- Bryan-South Pass Stage Road

Scale: 1:500,000

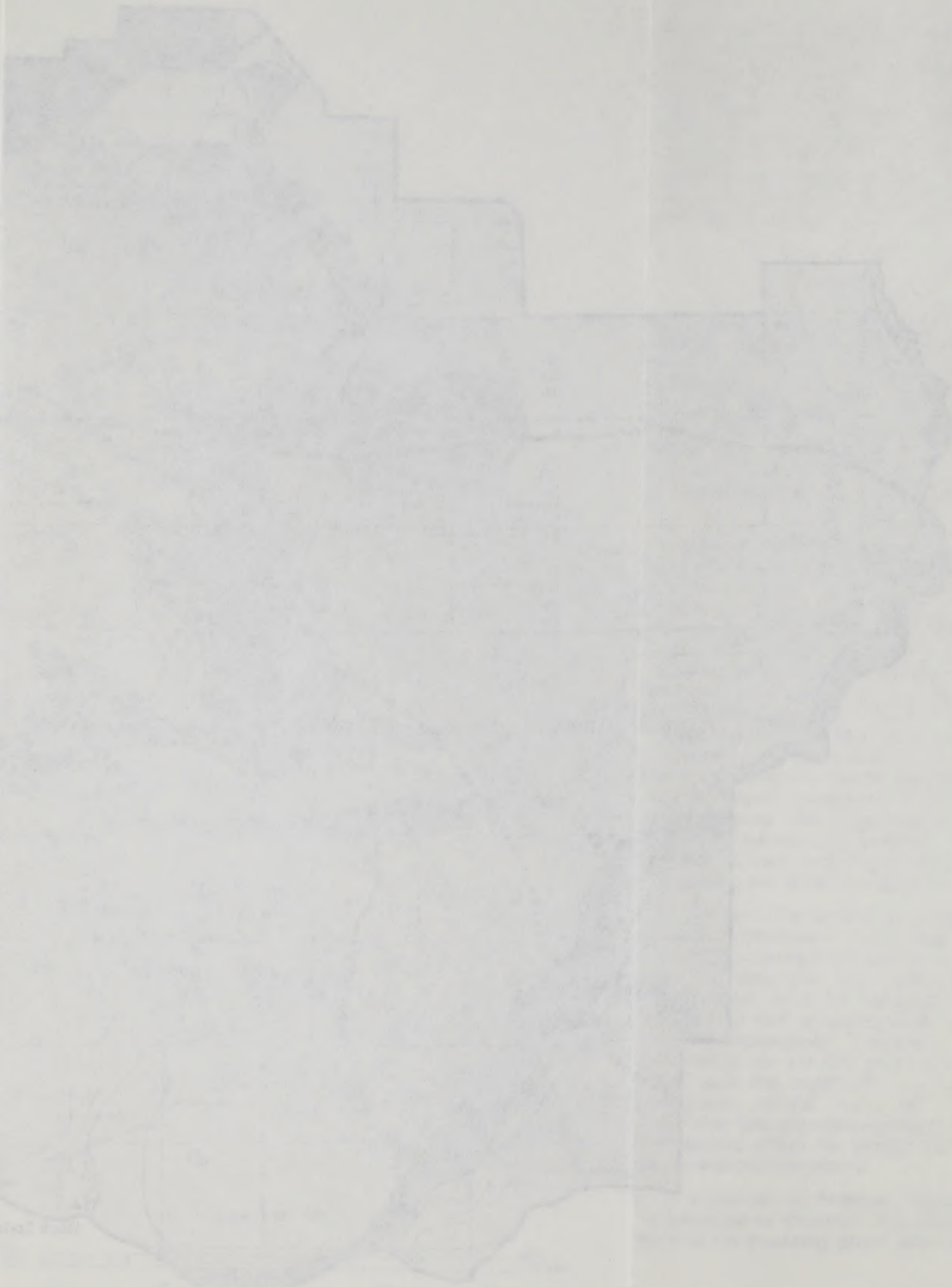
10 0 10 20 Miles

10 0 10 20 30 Kilometres

Map II-8A

MANAGEMENT CONSIDERATIONS
VISUAL RESOURCES AND HISTORIC TRAILS
BIG SANDY RESOURCE AREA

BIG SANDY – SALT WELLS
OIL AND GAS LEASING
ENVIRONMENTAL ASSESSMENT



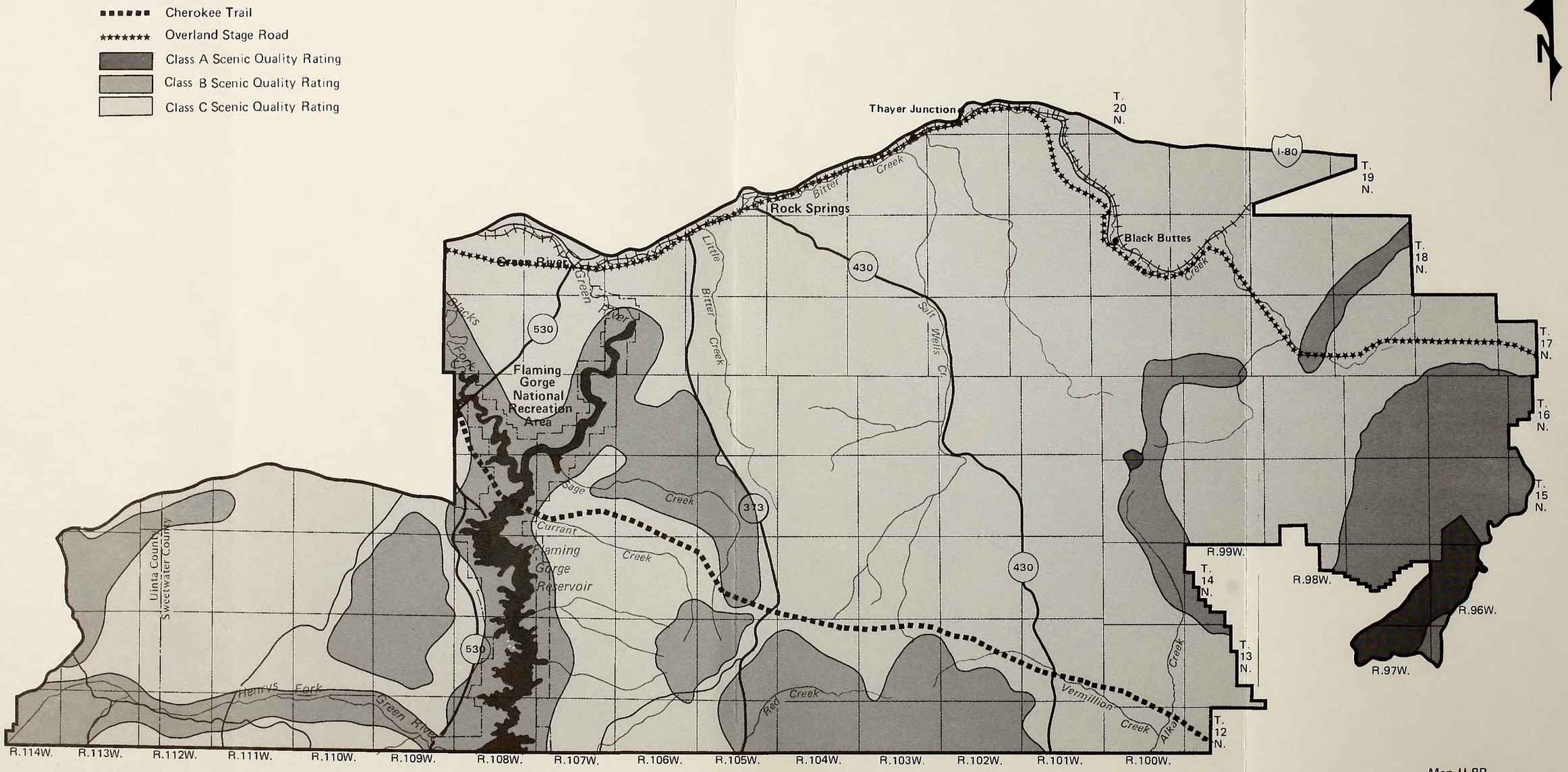
Cherokee Trail

Overland Stage Road

Class A Scenic Quality Rating

Class B Scenic Quality Rating

Class C Scenic Quality Rating



Scale: 1:500,000

10 0 10 20 Miles

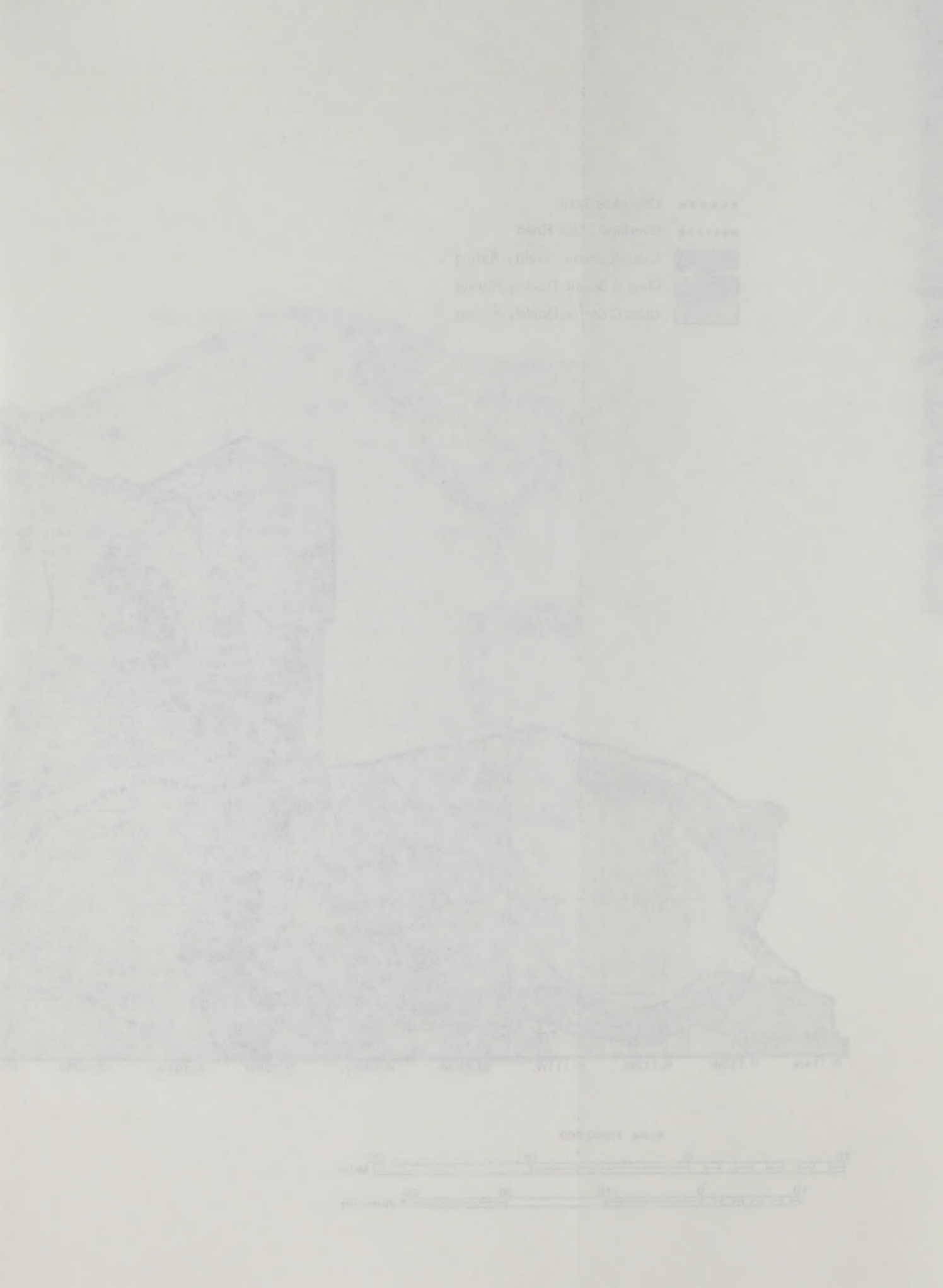
10 0 10 20 30 Kilometres

Map II-8B

MANAGEMENT CONSIDERATIONS VISUAL RESOURCES AND HISTORIC TRAILS

SALT WELLS RESOURCE AREA

BIG SANDY – SALT WELLS
OIL AND GAS LEASING
ENVIRONMENTAL ASSESSMENT



intensive cultural inventory is conducted by archeologists, and sites are either evaluated as eligible or identified as potentially eligible. Once identified as potentially eligible for nomination to the National Register, the particular cultural resource is afforded protection in perpetuity or until excavation transforms the physical site into notes, photographs, collections of artifacts and data. There is, however, a possibility that identification of a site as National Register quality may lead to unauthorized collection or vandalism, spoiling the qualities for which it was to be protected.

Impact No. 4, data recovery, is both beneficial and adverse in character. Recovery of data cannot occur until the resource is identified by archeologists during the predrilling period. Although considered beneficial at the time data recovery takes place, the process of excavation is irreversible and ultimately destructive. Current research methods and priorities may pass over sites or potential data within them which would have been important to future research. Such decisions may result in the loss of valuable cultural resource information.

Impact No. 5 (adverse) is the destruction of cultural resources in subsurface deposits. It is of major magnitude and is long term in duration. Disturbance of subsurface deposits may occur in the initial stages of exploration if drainage crossings are bulldozed for seismic equipment. Construction of well site and oil field facilities also poses the threat of unidentified values being destroyed. Untrained individuals would not recognize the more subtle manifestations of human occupation.

Impact No. 6 is the identification of highly visible sites in subsurface deposits. The impact can occur at any time during the various phases of oil and gas exploration and oil and gas field development, when cultural values may be recognized within subsurface deposits. This impact would be adverse if the cultural resources are collected by untrained individuals; it would be considered beneficial if the values are recognized and appropriate officials notified. Subsequent data recovery could be considered both beneficial and adverse as in Impact No. 4.

Cedar Canyon ACEC

An Area of Critical Environmental Concern has been identified to protect the cultural resources found in Cedar Canyon. This area is located approximately 20 miles north of Rock Springs (Map II-7A) and contains approximately 2,560 acres. Cedar Canyon is a unique natural system and is enclosed by surrounding cliffs. It is a scenic area and provides habitat for raptors. BLM's management recommendations include restriction of mineral development and reducing vandalism of the cultural resources and harassment of the raptors through such measures as controlling access and developing interpretive sites.

Oregon Buttes ACEC

An Area of Critical Environmental Concern has been identified to protect the cultural value of Oregon Buttes. It is located approximately 30 miles east northeast of Farson (Map II-7A) and contains approximately 3,840 acres. This area has high historical value due to its proximity to the Oregon Trail. It is highly scenic, and provides wildlife habitat. It is also a unique area because it exemplifies a natural system. BLM's management recommendations are to (1) restrict some types of recreation use (such as confine off-road vehicle use and overnight camping to specific areas); (2) develop interpretive nature trails; (3) take measures to control vandalism such as patrols; and (4) restrict mineral development within the area.

Natural Corrals ACEC

An Area of Critical Environmental Concern has been identified to protect the cultural resources found at Natural Corrals. Natural Corrals is located approximately five miles northeast of Superior (Map II-7A) and contains approximately 1,116 acres. The area has very unique geologic features, is highly scenic, and is widely explored by recreationists. BLM's management recommendations include restricting mineral development and consolidating the land ownership through a land exchange to provide uniform protection of values.

Pine Springs ACEC

An Area of Critical Environmental Concern has been identified to protect important cultural resources. Pine Springs is located approximately 43 miles southwest of the city of Green River (Map II-7B) and contains approximately 40 acres. In addition to having high archeological values, the area has a unique microclimate and associated plant community. BLM's management recommendation is to not allow any surface occupancy or disturbing activities within this area.

White Mountain Petroglyphs ACEC

An Area of Critical Environmental Concern has been identified to protect the important cultural resources of the White Mountain Petroglyphs. The petroglyphs are located approximately 20 miles

north of Rock Springs (Map II-7A). The petroglyph area (approximately 20 acres) also provides habitat for wildlife, including the golden eagle and mountain lion. BLM's management recommendations are to develop protective stipulations to control mineral development; develop measures to protect the petroglyphs from vandalism, including protective fencing; and provide interpretive information.

Aesthetics

Visual Resources

Visual resources are identified, analyzed, and managed by the BLM Visual Resource Management (VRM) system. A VRM inventory has not been completed for the assessment area. However, BLM has identified scenic quality areas through the planning process (see Maps II-8A and II-8B). Scenic quality areas represent the present situation; not management goals. A scenic quality rating of A represents the most scenic areas; a scenic quality rating of C represents the least scenic. Scenic quality ratings are one of several criteria used to develop VRM classes.

The VRM classes identify the amount of change (either improvement or degradation) envisioned for the area. VRM Class I allows for little or no alteration, while Class V would have very few restrictions.

The predominant VRM designation in the assessment area would most likely be classes III and IV (approximately 80 percent of the landscape). Potential wilderness areas, scenic Areas of Critical Environmental Concern (such as Cedar Canyon, Greater Sand Dunes, Oregon Buttes, Natural Corrals), and the Flaming Gorge National Recreation Area would most likely be designated Class I.

Impacts

Adverse impacts to the visual resource result from manmade additions to or alterations of the natural landscape. Structures such as powerlines and pumpjacks, and scars made by roads are intrusions; the degree of impact of these intrusions depends on their contrast with the natural landscape and their visibility. An intrusion temporarily changes the VRM class to V. If the intrusion is located on forested lands, ridgetops, or near highways or residential areas; they are highly visible and their impact is significant. Once the intrusions have been removed and reclamation is complete (including vegetation restoration), the area can revert to the original visual class.

Noise

Oil and gas development leads to significant increases in noise levels. Noise produced by equipment used in constructing roads, drilling wells, or pumping oil can be annoying. The change in noise level is most noticeable in rural areas where the primary noise source is the wind, but may be most objectionable in or near residential areas.

Land Uses

Existing use of Sweetwater County is predominately open range grazing, and it is anticipated that agricultural use will continue to be the dominant use. THK Associates (1980) reported that in 1979, 96% of the county lands were used for open range grazing, 1.6% for irrigated and dryland agriculture, 0.05% for extractive industries, and the remainder (2.35%) for urban, recreation, and right-of-way developments. The only anticipated changes in land use areas by 1990 are an increase to 0.09% in extractive industries with a corresponding decrease in open range grazing (THK Associates 1980). Approximately 0.03% of the total surface area of Sweetwater County will be affected by projected increases in oil and gas, coal, trona, and other extractive industries.

Socioeconomic Conditions

Historically southwestern Wyoming's economy was structured around livestock production and an agrarian way of life. Coal production was initiated in the region with the development of the Union Pacific Railroad in the late 1800's. Development of diesel-powered locomotives reduced the demand for coal and resulted in the closure of many coal mines in the region. Oil and gas production became a part of southwestern Wyoming's economy in the early 1900's. The South Baxter Basin Field located in the Salt Wells Resource Area was discovered in 1922.

Trona mining acted as a major economic stimulus to the region in the early 1950's, and a major portion of the recent development in Sweetwater County can be associated with the soda ash industry. Boom growth was experienced in the Rock Springs and Green River area with the construction of the Jim Bridger Power Plant (coal-fired generator) in 1973. Mining and energy development have been the major contributing factors to the rapid development of southwestern Wyoming.

The assessment area covers portions of Sweetwater, Lincoln, Sublette, Uinta, and Fremont counties in southwestern Wyoming. A majority of the assessment area's land and population are contained in Sweetwater County. The assessment area lands contained in the other four counties are very sparsely populated. For the purposes of this analysis, Sweetwater County will be considered as the economic base for income, employment, and population.

Oil and gas production from 1977 to 1979 and drilling activity in the region will be used as the basis to predict future oil and gas production in the assessment area. Oil production in the assessment area has declined from 7,714,798 barrels in 1977 to 5,824,578 barrels in 1979. For the purposes of this analysis, new wells and secondary recovery techniques will be assumed to maintain oil production from the assessment area at its present level until 1986. Gas production from the assessment area has increased from 102,096,496 thousand cubic feet (MCF) in 1977 to 131,688,356 MCF in 1979. Projections of gas production from 1981 to 1986 are shown in Table II-10. From 1986 to 1991 oil and gas production from the assessment area is expected to decline in relative importance compared to other industries in the area.

Employment and Income

Table II-11 shows employment by major industrial sector from 1971 to 1979. Employment in the mining sector which includes the oil and gas industry has grown 278% from 1971 to 1979, and now controls 29% of the total labor force in Sweetwater County. Agriculture is the only industry to have fewer employees in 1979 than 1971, although the construction industry showed a rapid growth in employment through 1975 and then a decline in total employment to 1979. Total employment in Sweetwater County increased 151% between 1971 and 1979.

Unemployment rates for Sweetwater County are shown in Table II-12. Unemployment rates were higher for every month in 1980 than 1979 for both Sweetwater County and Wyoming. Unemployment rates in Sweetwater County were 4.5, 4.8, and 4.6% for January, February, and March 1981, respectively, compared to national rates of 7.4, 7.3, and 7.3% during the same time period.

Employment projections resulting from increased gas production in the assessment area are shown in Table II-13. The greatest yearly increase in employment is projected at 41 direct employees and 75 service sector employees during 1981. The cumulative increase in employment from 1981 to 1986 is estimated at 196 direct employees and 344 service sector employees. Due to the low unemployment rate in Sweetwater County (nationally frictional unemployment is estimated at 2 to 4%, Gill 1976), most of the work force could be expected to come through in-migration to the region.

The mining industry showed the largest increase in labor and proprietors income of all industrial sectors in Sweetwater County (Table II-14). Income from the mining sector increased 838% in the 8-year period, from $17 million in 1971 to $160 million in 1979. The construction industry grew at a more rapid pace, with income increasing 1,327% from 1971 to 1975, and then a slower growth rate of 4% from 1975 to 1979. Agriculture was the only industrial sector to show a decrease in total labor and proprietors income from 1971 to 1979.

Table II-13 shows the projected increase in total personal income resulting from increased gas production in the assessment area. The largest yearly increase in personal income is expected in 1981 when direct personal income from wages and salaries is expected to increase by $2 million and indirect and induced personal income is projected to increase by $1.74 million. The cumulative increase in personal income from 1981 to 1986 is estimated at $17.8 million. Per capita personal income would be expected to increase slightly from higher average wages paid to employees in the oil and gas industry. Average weekly wages of crude petroleum and natural gas workers in Wyoming was $501.78 in the fourth quarter of 1980 (Wyoming Employment Security Commission 1980).

Population

Green River showed the highest population growth rate of all towns in Sweetwater County, with a 10-year increase of 205% from 4,196 residents in 1970 to 12,807 in 1980 (Table II-15). In comparison Rock Springs' population increased 67% during the same time period, and the total population increase was only 814 fewer residents than Green River. Sweetwater County showed the second highest growth rate of all counties in Wyoming, only surpassed by Converse County (Census Bureau 1980).

Population projections resulting from increased gas production in the assessment area are shown in Table II-16. As expected, the highest population increase is projected for 1981 when the greatest increase in total employment is expected. A total of 215 new residents will be expected in 1981, and cumulative population increases from the increased gas production in the assessment area from 1981 to 1986 is projected at 1,001 new residents.

Table II-10

ESTIMATED GAS PRODUCTION WITHIN THE ASSESSMENT AREA
1981 TO 1986
(In Million Cubic Feet-MMCF)

1981	1982	1983	1984	1985	1986
143,946	148,885	153,351	157,458	161,280	164,870

Note: The following equation was used to project future gas production:

$(x - 77) = 2.283944^{-9} (y - 102,096)$ Where "x" equals the production year and "y" equals total gas production.

Table II-11

EMPLOYMENT BY MAJOR INDUSTRIAL SECTOR FOR SWEETWATER COUNTY

	1971		1975		1979	
Industrial Sector	No.	Percent	No.	Percent	No.	Percent
Agriculture	317	4	217	1	127	1
Mining	1,666	19	3,933	23	6,294	29
Construction	444	5	3,799	22	2,729	12
Manufacturing	172	2	285	2	402	2
Transportation	831	10	1,288	8	1,619	7
Wholesale Trade	186	2	399	2	639	3
Retail Trade	1,343	15	2,172	13	3,220	15
Finance	161	2	242	1	369	2
Service	1,288	15	1,786	10	2,359	11
Public Administration	1,660	19	2,181	13	2,717	13
Miscellaneous	609	7	854	5	1,261	5
Total	8,677	100	17,156	100	21,736	100

Source: Wyoming Employment Report, prepared by Division of Research and Statistics, Department of Administration and Fiscal Control, State of Wyoming, 1st and 2nd edition, December 1979 and May 1981.

Table II-12

UNEMPLOYMENT TREND

	1979 Unemployment Rate												
County/State	(Dec. 78)	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Trend
Sweetwater	3.3	3.2	2.6	2.3	2.9	2.5	2.9	2.8	3.1	2.7	2.7	2.9	2.8	Stable
Wyoming	3.6	4.0	3.3	3.0	2.8	2.2	2.5	2.4	2.4	2.3	2.2	3.0	3.4	-0.5%

	1980 Unemployment Rate											
County/State	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Sweetwater	4.0	3.7	3.4	3.4	2.8	3.9	3.3	3.4	3.0	3.5	4.6	3.5
Wyoming	4.2	4.1	3.9	3.6	3.4	3.9	3.6	3.3	3.2	3.2	4.5	4.1

Source: Civilian Labor Force and Unemployment, Job Service of Wyoming.

Table II-13

EMPLOYMENT AND PERSONAL INCOME INCREASE PER YEAR
FROM NATURAL GAS DEVELOPMENT IN THE ASSESSMENT AREA

	1981	1982	1983	1984	1985	1986
Increased Direct Employment From the Gas Industry[1/]	41	37	33	30	29	26
Indirect and Induced Employment [2/]	75	62[7/]	58[7/]	53[7/]	51[7/]	45[7/]
Total Increase in Employment	116	99	91	83	80	71
Personal Income Increase Resulting From Direct Employment[3/]	$1,146,360	$1,034,520	$ 922,680	$ 838,800	$ 810,840	$ 726,960
Indirect and Induced Personal Income From Direct Employment[4/]	$1,421,486	$1,282,805	$1,144,123	$1,040,112	$1,005,442	$ 901,430
Personal Income Increase Resulting From Secondary Employment[5/]	$ 892,500	$ 737,800	$ 690,200	$ 630,700	$ 606,900	$ 535,500
Indirect and Induced Personal Income From Secondary Employment[6/]	$ 321,300	$ 265,608	$ 248,472	$ 227,052	$ 218,484	$ 192,780
Total Increase in Personal Income	$3,781,646	$3,320,733	$3,005,475	$2,736,664	$2,641,666	$2,356,670

1/ Projected from BLM Input/Output Model for Sweetwater, Albany, and Carbon counties, based on gas production estimates from Table II-10 and a selling price of $2.46/MMBtu (Section 103, Natural Gas Policy Act of 1978, for June 1981).

2/ Direct, indirect, and induced employment multiplier of 2.84 (BLM Input/Output Model).

3/ Wages of oil and gas workers estimated at $27,960/year, based on average weekly wages for employees in the mining sector (includes oil and gas employees) in Sweetwater County (Fourth Quarter 1980 State and County Summary of Covered Employment).

4/ Type II income multiplier of 2.24 (BLM Input/Output Model).

5/ Wages of service sector employees estimated at $11,900/year, based on average weekly wages for employees in the retail and service sectors in Sweetwater County (Fourth Quarter 1980 State and County Summary of Covered Employment).

6/ Type II income multiplier of 1.36 (BLM Input/Output Model).

7/ Direct, indirect, and induced employment multiplier of 2.76 (BLM Input/Output Model).

Table II-14

INCOME BY MAJOR INDUSTRIAL SECTOR FOR SWEETWATER COUNTY[1/]

Industrial Sector	1971 Dollars	1971 Percent[2/]	1975 Dollars	1975 Percent[2/]	1979 Dollars	1979 Percent[2/]
Agriculture	2,086	4	2,023	1	1,385	[3/]
Mining	17,068	29	68,002	33	160,102	42
Construction	4,414	8	62,989	30	65,207	17
Manufacturing	1,644	3	3,987	2	7,976	2
Transportation	8,466	14	18,601	9	37,547	10
Wholesale Trade	1,387	2	4,870	2	10,953	3
Retail Trade	6,626	11	15,311	7	30,126	8
Finance	1,243	2	2,455	1	5,445	1
Service	6,717	11	14,327	7	35,698	9
Public Administration	8,629	15	15,709	7	31,107	8
Miscellaneous	0	1	0	1	--	--
Total	58,818	100	208,311	100	385,546	100

Note: "0" is used to prevent disclosure of confidential information. The data is included in column totals.

Source: Wyoming Income Report, prepared by Division of Research and Statistics, Department of Administration and Fiscal Control, State of Wyoming, 1st and 2nd edition, Cheyenne, Wyoming, December 1979 and September 1980.

[1/]Numbers reported in thousands of dollars.

[2/]Percentages are rounded to the nearest whole number.

[3/]Less than 0.5 percent of the column total.

Table II-15

SWEETWATER COUNTY POPULATION ESTIMATES[1/]

	1970	1980	Percentage Increase
Rock Springs	11,657	19,454	67
Green River	4,196	12,807	205
South Superior	197	586	197
Eden/Farson[2/]	--	478	--
Point of Rocks[2/]	--	267	--
Wamsutter[3/]	139	681	390
Sweetwater County	18,391	41,723	127

[1/]1980 Census of Population and Housing, U.S. Department of Commerce, Bureau of Census.

[2/]Population Projection 1979-1990 Sweetwater County, Wyoming, THK Associates, Incorporated, December 1979.

[3/]Wamsutter is not within the Rock Springs District boundary.

Table II-16

POPULATION INCREASE AND ADDITIONAL HOUSING AND SCHOOL ENROLLMENT REQUIREMENTS DUE TO NATURAL GAS DEVELOPMENT IN THE ASSESSMENT AREA

	1981	1982	1983	1984	1985	1986
Population Resulting from Direct Employment[1/]	59	54	49	43	43	38
Population Resulting from Indirect and Induced Employment[2/]	156	128	121	110	106	94
Total Population Increase	215	182	170	153	149	132
Bachelor Residences[3/]	13	12	10	10	9	9
Family Residences[4/]	55	46	44	39	38	33
Total Housing Requirement	68	58	54	49	47	42
Additional School Enrollments[5/]	72	60	56	52	49	44

1/ Assume 80% of the new gas industry employees move into the region single and the remaining 20% are married and bring their families with them (Population Impact Estimates for 1981 and 1982, Overthrust Belt Impact Region, Lincoln Uinta Association of Governments-LUAG 1981). Average family size is estimated at the national average of 3.3 (U.S. Department of Commerce, Bureau of the Census).

2/ Assume that 30% of service sector work force requirements will be provided by spouses and children, and 90% of the new service sector employees are married and they will move their families to the region with them. The remaining 10% of service sector employees will come to the region single status (LUAG 1981). The average family size is assumed to equal the national average of 3.3 (Bureau of Census).

3/ Assume 80% of single status gas industry employees will live in housing provided on well sites and construction sites. All remaining single status employees will require bachelor residences.

4/ All married employees bringing their families to the region will require a family residence.

5/ School enrollments are based on 1.3 children per family, and all children are assumed to be of school age.

Housing

The number and type of housing units available in Rock Springs, Green River, and Sweetwater County are shown in Table II-17. A total of 345 new housing units were constructed in Rock Springs and Green River during 1980 (pers. comm., Richard Bokma 1981). Due to the 41 new multi-family units, a total of 776 living units are provided by the 345 new housing units. The large population influx in recent years has created a high demand for housing. The 1981 Rock Springs Community Profile lists the cost of a new 3-bedroom home with 1,100 square feet of floor space, unfinished basement, and 1-car garage at a value of $78,000. In comparison a 3-bedroom house rents for $600 per month (1981 Rock Springs Community Profile). The Rock Springs City Planner estimates a vacancy rate of less than 1% in Rock Springs (pers. comm., Rich Unger 1981).

Projections of additional housing requirements resulting from increased gas production in the assessment area are shown in Table II-16. The highest yearly increase in housing requirements would be in 1981 when 13 bachelor residences and 55 family residences would be required. Over the 5-year period from 1981 to 1986, a total of 255 family residences and 63 bachelor residences would be required to house the additional employees resulting from natural gas development in the assessment area.

Schools

The 1980 school enrollment, recommended capacity, and maximum capacity of public schools in Sweetwater County are shown in Tables II-18 and II-19. In all schools except Washington Elementary School in Rock Springs, 1980 enrollment is less than the maximum capacity. In Washington School the 1980 enrollment exceeded the maximum capacity by 25 pupils. In general there is some space available in the local schools before maximum capacity becomes a limiting factor, although operating near recommended capacity would be preferable.

Table II-16 shows the additional school enrollments resulting from development of gas reserves in the assessment area. The highest enrollments of 72 pupils would be expected in 1981. A total increase of 333 pupils could be expected over the 5-year period. When these school enrollments are distributed throughout both school districts, a major impact is not expected from additional school enrollments.

Social Services and Infrastructure

Due to the developed nature of the Rock Springs and Green River area, a major impact on health, recreation, and public and social services would not be expected from the increased population that would result from gas development in the assessment area. It is the effect of gas development in the assessment area combined with future energy and mineral developments that would result in impacts on local services from excessive use. As an example the new sewage treatment facility constructed in Rock Springs is already operating at full capacity.

Revenues

Direct and indirect revenues produced from the sale of the additional gas production projected (Table II-10) are shown in Table II-20. Indirect revenues are generated from additional business spending in the region as a result of purchases of goods and services used in the production of gas from the assessment area. Total direct and indirect revenues projected for the 5-year period from 1981 to 1986 are approximately $65 million and $35 million (1981 dollars), respectively.

Revenues are received by state and federal governments from taxes and royalties paid on oil and gas production. The oil and gas industry pays two forms of production taxes in addition to personal property and income taxes. An ad valorem production tax was levied on the assessed valuation of oil and gas production in 1980 at a rate of 63.196 mills and 64.008 mills, respectively. In addition, a severance tax of 4% (2% on oil produced from stripper, low- production wells) was levied on the assessed value of oil and gas production in 1980. Table II-21 shows the ad valorem production tax and severance tax collected in Sweetwater County on oil and gas production from 1977 to 1980. The oil and gas industry also pays sales tax (4% in Sweetwater and Uinta counties; and 3% in Fremont, Lincoln, and Sublette counties) on purchases inside the state. Use tax is collectable at a rate of 3% on purchases from vendors outside Wyoming.

Royalties are collected on oil and gas produced from state and federal lands. One-half of the federal royalties are returned to the state for their use.

Lifestyles

Up until the early 1900's Sweetwater County's economy had been structured around agriculture and a rural way of life, with the major industrial development being the Union Pacific Railroad and the

Table II-17

HOUSING CHARACTERISTICS IN SWEETWATER COUNTY
Existing Housing-1979

County/ Community	Total Units	Single-Family	Multi-Family	Mobile Homes
Sweetwater County[1/]	13,463	5,999	3,514	3,950
Rock Springs	7,469	3,234	2,841	1,394
Green River	3,498	2,056	557	885
Balance of County	2,496	709	116	1,671

Source: 1979 Sweetwater County Land Use and Housing Update (Draft), THK Associates, Incorporated.

Housing Constructed in Rock Springs and Green River-1980

Community	Total Units	Single-Family	Multi-Family	Total Living Units
Rock Springs	132	101	31	255
Green River	213	203	10	521

Source: Department of Economic Planning and Development, pers. comm., Richard Bokma 1981.

Table II-18

SUMMARY OF SCHOOL FACILITIES
SWEETWATER COUNTY SCHOOL DISTRICT NO. 1

Location	Name	Capacity Recommended*	Capacity Maximum	1980 Enrollment
Elementary (K-6, 8)				
Rock Springs	Desert View	320	410	331
	Lincoln	320	410	314
	Lowell	135	180	156
	Overland	520	650	533
	Roosevelt	135	180	153
	Walnut	320	410	302
	Washington	310	350	375
	Yellowstone	430	550	362
		2,490	3,140	2,526
Reliance	Reliance	350	370	358
Wamsutter	Desert (K-8)	230	300	234
Superior	Superior	160	190	92
Farson-Eden	Farson-Eden	200	275	234
Secondary				
Rock Springs	East Jr. High (7-9)	800	1,100	598
	White Mt. Jr. (7-9)	800	1,000	517
	Senior High (10-12)	1,120	1,400	977
		2,720	3,500	2,092
Farson-Eden	Farson-Eden High (7-12)	100	135	71

*Recommended by the School District.

As an additional service, the district shares its facilities with the community. A full-time community services director coordinates the use of school facilities, including two swimming pools, one handball court, two auditoriums, gymnasiums, and playgrounds. The facilities are open from 5:00 p.m. to midnight and nominal fees are charged at the discretion of the district.

Source: School District No. 1.

Table II-19

SUMMARY OF SCHOOL FACILITIES
SWEETWATER COUNTY SCHOOL DISTRICT NO. 2

Location	Name	Capacity Recommended	Capacity Maximum	1980 Enrollment
Elementary (K-6)				
Green River	Harrison	700	875	603
	Roosevelt	440	550	291
	Washington	540	675	214
	Wilson	480	600	407
	Monroe Upper Elementary (5 & 6)	540	575	548
		2,700	3,275	2,063
Granger	Granger (K-8)	100	125	55
McKinnon	McKinnon (K-8)	60	75	29
Thoman Ranch	Thoman Ranch	N/A	N/A	6
Secondary (7-12)				
Green River	Lincoln Jr. High (7 & 8)	580	725	478
	Green River High (9-12)	1,040	1,300	853
		1,620	2,025	1,331

The district shares its various gymnasiums, the swimming pool, and classrooms with the community for recreation and adult education programs.

Source: School District No. 2.

Table II-20

REVENUES RECEIVED FROM ADDITIONAL GAS
PRODUCTION IN THE ASSESSMENT AREA[1/]

	1981	1982	1983	1984	1985	1986
Direct Revenue[2/]	$13,793	$12,151	$10,986	$10,102	$ 9,043	$ 8,832
Indirect Revenue[3/]	7,393	6,513	5,888	5,415	4,847	4,734
Total Revenue	21,186	18,664	16,874	15,517	13,890	13,566

1/ Numbers reported in thousands of dollars.

2/ Calculated from the June 1981 (Natural Gas Policy Act of 1978) Section 103 price of $2.46 per MMBtu. Rounded to the nearest $1,000. Gas prices are not adjusted for inflation or possible deregulation in 1985.

3/ Business multiplier of 1.536 supplied by BLM Input/Output Model for Sweetwater, Carbon, and Albany counties.

Table II-21

AD VALOREM PRODUCTION TAX AND SEVERENCE TAX COLLECTED
FROM OIL AND GAS PRODUCTION IN SWEETWATER COUNTY

	Oil Production		Gas Production	
Year	Ad Valorem Production Tax	Severance Tax[1/]	Ad Valorem Production Tax	Severance Tax
1980	7,447,554	N/A	10,039,370	6,273,822
1979	7,715,628	N/A	5,045,560	3,147,795
1978	6,306,114	N/A	3,348,185	2,115,924
1977	5,817,858	N/A	2,348,828	1,493,287

Source: Assessed valuation provided by 1980 Wyoming Mineral Yearbook, State Department of Economic Planning and Development, Mineral Division. Annual mill levy provided by State of Wyoming Annual Report, Department of Revenue and Taxation, Ad Valorem Tax Division, 1980, 1979, 1978, and 1977.

1/ N/A indicates the data was unavailable.

associated coal mines. Oil and gas production began in the 1920's, and has continued through boom and bust up to the present time. The oil and gas industry is typified by discovery and rapid development (boom) and a slow declining production (bust). Many social problems are realized with the rapid development that takes place. Increased vandalism, alcoholism, theft, and violent crimes were all realized in nearby Evanston, Wyoming, with the development of the Whitney Canyon-Carter Creek gas processing plants and other oil and gas related developments in the area (BLM 1980b).

Lifestyles in Sweetwater County today, can be described as a mixture of people from many diverse backgrounds into a conglomerate group. The major influences are agriculture, oil and gas, and other mineral industry developments.

IMPACTS OF THE ALTERNATIVES AS COMPARED TO THE PROPOSED ACTION

The following discussion compares impacts of the proposed action and alternatives. In those resources where the impacts of the alternatives would be similar to the proposed action, the comparison has not been addressed.

Air Quality

Alternative 1 would result in a slight overall reduction in disturbing activities with a proportionate decrease in poliutants. Alternative 2 would permit a larger amount and less regulated type of activity with noticeably greater impacts to air quality.

Mineral Resources

Alternative 1 would result in the extraction of lesser amounts of hydrocarbons than the proposed action and lesser amounts of sand, gravel, and fill material than the proposed action. Alternative 2 would allow higher levels of production with commensurate consumption of sand, gravel, and fill material.

Geologic Hazards

Alternative 2 would increase the chances of landslides and slumps on 228,300 acres.

Soils

Alternative 2 would result in higher levels of erosion on 1,489,002 acres of highly erodible soils.

Water Resources

Alternative 2 would preclude the improvement of water quality and sediment yield from 850,003 acres of fragile watersheds.

Vegetation

The impacts to vegetation are relative to the degree of activity. Alternative 1 would have slightly less activity than the proposed action; Alternative 2 would have a greater degree of activity.

Wildlife

Alternative 1 would provide a greater degree of protection to 36,710 acres of elk calving areas. Alternative 2 would only offer protection to 60 percent of the big game crucial winter range and 30 percent of the identified sage grouse habitat.

Livestock Grazing

Alternative 2 would not restrict use of 281,836 acres of range lambing grounds.

Wild Horses

Alternative 1 would prioritize wild horse needs above oil and gas development on 1,661,324 acres.

Recreation

Alternative 1 would give recreation use a higher priority on 41,040 acres.

Wilderness

Alternative 1 would provide a higher degree of protection for wilderness values in 14 WSAs totaling 224,365 acres.

Cultural Resources

Alternative 2 would result in higher levels of disturbance of 7,576 acres.

SUMMARY

Several points should be made with respect to the probable future impacts of oil and gas development in the area.

First, times have changed. Not many years ago, little or no consideration was given to environmental consequences of energy development. GS approved and supervised activities without input from BLM. It is not reasonable to project impacts for the next 20 years based upon impacts created in the last 20 years.

Second, energy production is more complex, demanding, and profitable than it ever has been. Companies have more technological capabilities and more capital available for mitigation and reclamation than ever before.

Third, much of the process of oil and gas development is outside the control and influence of BLM. State and other federal agencies have both regulatory and supervisory functions. Some of these functions may take precedence over environmental concerns. An example of this is in the area of well site location. In many cases, the Wyoming Oil and Gas Commission requires that wells be located within certain portions of a section. Even when such spacing requirements are not in effect, operators may wish to space exploratory wells in accordance with these patterns in order to be able to drill a maximum number of wells, should the area eventually fall under spacing orders. This real or imagined inflexibility can limit the opportunity to locate drill sites in the most environmentally acceptable locations.

Fourth, many of the adverse impacts associated with oil and gas activity result from the operation and maintenance phases of producing fields. A major source of sedimentation is deteriorating roads or poorly maintained roads. Off-road vehicle use increases dramatically in areas of oil and gas activity. Oil field workers "explore" their new homes and others take advantage of roads and trails opened by the petroleum industry. Disturbance of wildlife will increase as will collecting of artifacts, littering, vandalism, etc.

Many of these areas of impact are conceivably within the area of BLM regulation and supervision, while others are not. Although BLM is directed to process APDs and rights-of-way applications, present manpower and funding limitations prevent BLM from providing daily supervision; this situation is expected to continue. In addition, the idea of increased regulation or supervision of private activities by BLM or any other government agency has become increasingly distasteful to the general public. Many private citizens seem to be asking for the impossible dream; complete freedom for unrestrained personal activity in an unspoiled setting. Sociologists advance many interesting theories about the dramatic increases in petty theft, vandalism, and destruction of private and public property. An increase in people due to oil and gas activity will result in a corresponding increase in incidents of this nature.

CHAPTER III

MITIGATING MEASURES AND RESIDUAL IMPACTS

MITIGATING MEASURES

This section identifies reasonable mitigating measures which could be applied to eliminate or reduce adverse impacts of oil and gas development activities.

Mitigation is typically applied at two levels in the development process. The first (Category 1) is at the lease level. These mitigation measures become a condition of a lease which would govern most any activity conducted on the lease. These mitigation measures can be attached to the lease, without knowledge of any specific development plan. An example of such a mitigating measure is: No occupancy or other surface disturbance will be allowed on slopes in excess of 25 percent.

The second level of mitigation (Category 2) is site specific. These measures are applied once the specific lease development plan is known and the facilities have been identified; e.g., well sites, access roads, and support facilities. The lessee will usually file an application for permit to drill (APD) for activities on the lease and the service companies (i.e., utility companies) would apply for a right-of-way for projects to be constructed or operated by them (powerlines, pipelines, etc.). At this time a field investigation is conducted to identify specific concerns. Representatives of the applicant, BLM personnel, and Geological Survey personnel may take part in the field examination. Extensive discussion and negotiation may take place at this level.

The responsibility for mitigation of impacts belongs to several federal, state, and local agencies, as well as private concerns. Chapter I, Authorizing Actions describes the agencies and their area of responsibility in regard to mitigation of the impacts identified in this assessment.

During development of this EA, existing practices were reviewed. Appendix C contains the standard stipulations that are presently attached to leases, geophysical exploration notices of intent, permits, APDs, and rights-of-way. It is recommended that all of those stipulations be continued in their present form except as noted in Appendix D.

During preparation of this EA, impacts were identified which are not currently being adequately mitigated. Measures were identified which would remedy these situations. These measures are described by resource component, in two categories. The first category is those measures which involve restrictions on the timing or manner of use allowed over a relatively large area. The second category deals with impacts and measures that are localized in nature.

Category 1

Present practices in this category are the standard oil and gas lease stipulations (Appendix C, Numbers 1-11, and Maps A-1A and A-1B) which are applied to leases which are renewed or issued for the first time. These stipulations have only been applied to leases since July 1972. There are many leases currently in effect and available for development which are not subject to these stipulations. In some cases, operators have submitted to the application of these stipulations voluntarily, especially when other leases they hold are subject to the stipulations.

These stipulations (Standard Oil and Gas Lease Stipulations) should also be attached to any authorizing actions as appropriate. Additional measures are recommended as follows:

Areas of Critical Environmental Concern (ACECs)

Eight ACECs have been identified which, if established, would constrain oil and gas activities. A specific stipulation should be developed for each of these ACECs, reflecting those constraints (see Table I-9 in Chapter I, Proposed Action).

Mineral Resources

Recent planning efforts have identified areas with known potential for other minerals. This fact should be noted on the appropriate leases as follows: "This lease is subject to (coal lease, trona lease, or PRLA number)." Stipulations addressed to simultaneous operations will be attached at the time of approval of the application for permit to drill. Plans for oil field development and proposed secondary recovery will be made in cooperation with GS and the lease holder.

Soils and Water Resources

Detailed soil surveys, water quality monitoring, and multiple use planning have identified specific areas where all disturbing activities should consider special problems of erosion susceptibility or construction hazards. These areas are listed on Table II-5, Designated Problem Watershed Areas (see Chapter II, Water Resources).

Stipulations should be developed for each of these areas requiring soil conservation and erosion control measures in accordance with the existing or proposed watershed plans or any other appropriate plans.

Rationale. Where special management requirements are known, every effort should be made to inform operators of potential conflicts as early as possible.

Livestock Grazing

Range lambing areas identified on Maps II-6A and II-6B should be afforded the same seasonal protection as crucial wildlife areas. A stipulation should be developed requiring, at a minimum, notification and close coordination with livestock operators between May 10 and June 20.

Rationale. A surprise disruption of a lambing herd can cause significant financial loss to a sheep operation through the bumming (orphaning) of lambs. Through coordination, this impact can be avoided or minimized.

Wildlife

Studies have shown the importance of calving areas to the health and well being of the elk populations. Known elk calving areas (Map I-4) should be added to Stipulation No. 7 with the period of restriction being from May 10 to June 30.

Rationale. Disturbance in elk calving grounds increases calf mortality. Additional calving areas should be added as they are identified.

Category 2

These measures deal with more specific problems and solutions. Stipulations attached to an oil and gas lease are designed to protect the environment by mitigating impacts over a broad geographic area. The specific locations where drill pads and roads will be needed are not known when the lease is issued. At the time the lessee submits an application for permit to drill a well (APD) or applies for a right-of-way, environmental problems pertaining to that individual case must be dealt with. After a field examination of the proposed drilling location or right-of-way, the BLM attaches stipulations to the right-of-way grant or requests that Geological Survey attach them to the APD for protection of the surface resources.

Due to inadequacies in present stipulations, or their inconsistent application, some adverse environmental impacts are occurring unnecessarily as a result of oil and gas activities. These mitigating measures would reduce the adverse impacts if effectively implemented.

Air Quality

Impacts to air quality include: increased amounts of dust resulting from vehicle travel and surface disturbance, exhaust emissions, possible release of hydrogen sulfide gas, and smoke resulting from flaring of gas or fires. Some measures which will partially alleviate these impacts are: the prevention and suppression of fire, elimination of unauthorized burning of debris, use of dust abatement measures on access roads, and covering topsoil stockpiles with mulch, netting, or canvas to reduce dust and soil loss.

Mineral Resources

Impacts to mineral resources include depletion of sand and gravel supplies, and conflicts with removal of other minerals, in particular, those minerals removed by stripmining, such as coal and oil shale. (The latter situation is addressed by the Geological Survey in their stipulations pertaining to well abandonment.)

To avoid a trespass situation resulting from unauthorized removal of materials for road surfacing, any APDs which do not specify a materials source should have an information statement added which states, "A sales contract for scoria and/or sand and gravel is required prior to the removal of these materials from an area of federally owned minerals."

Topography

The topography is modified during construction of well pads and some access roads. These impacts can be modified during reclamation by returning the land back to approximately the original topography. To the extent possible, roads should follow natural contours.

Soils and Water Resources

The principal impacts to soils include: compaction, mixing, burial, and contamination. Impacts to water quality include sedimentation and contamination. These impacts can be reduced by preventing contamination and by successful reclamation of disturbed areas. Some of the specific measures which have been developed to reduce impacts to soils are: (1) stripping topsoil and stockpiling it until used for rehabilitation of the site; (2) use of erosion control materials to prevent wind and water erosion of topsoil as well as retention of soil moisture; (3) proper construction of reserve pits on steep slopes (25% or more) including placement of 50% of the pit in the cut or next to the backslope (topsoil can sometimes be stockpiled above the backslope)—this prevents pit failure as well as making recontouring easier; and (4) piling snow downhill from topsoil stockpiles.

The following measures will reduce impacts to water resources: (1) using portable reserve pits next to perennial streams; (2) building trenches above reserve pits to divert surface runoff away from the pit; and (3) avoiding drainages when constructing roads.

Vegetation

Impacts to vegetation include: tree mortality, vegetative loss due to surface disturbance, undesirable changes in the plant community, and smothering of vegetation by dust. These adverse impacts can be mitigated by prompt rehabilitation of disturbed areas. These measures will help mitigate the adverse impacts: (1) limit surface disturbance to essential disturbance only; (2) adhere to site-specific revegetation plan (Appendix E); (3) fence rehabilitated areas where feasible until vegetation is well established; and (4) use snow fences to direct drifting where it can increase the moisture available to newly seeded areas.

Wildlife

Impacts to wildlife include: habitat loss, human disturbance, noise, and contamination and sedimentation of streams and reservoirs (impacting both water supplies and aquatic habitat). These impacts can be reduced by employing the following measures: (1) minimizing habitat loss through careful planning of surface disturbing activities and through prompt revegetation of disturbed areas; (2) proper construction of reserve pits, thereby reducing the incidence of pit failure and subsequent contamination; (3) avoidance of drainage bottoms and streams when constructing facilities, thereby reducing sedimentation; (4) limiting access to essential roads only, thereby reducing human disturbance; (5) limiting stress-producing noise (muffling engines); and (6) restricting activity within essential wildlife habitat during critical time periods.

Livestock Grazing

The primary impacts to livestock are increased harassment due to human disturbance and some hazard to livestock from unfenced reserve pits. These impacts could be mitigated by (1) limiting activity during critical time periods such as lambing and calving seasons and (2) encouraging prompt (first season) rehabilitation of reserve pits.

Cultural Resources

Impacts to cultural resources include: disturbance of cultural sites, such as crushing of artifacts and compression and displacement of near-surface deposits; removal of artifacts and vandalism; and destruction of cultural resources in subsurface deposits. Mitigating measures which will partially alleviate the adverse impacts include: (1) requiring an intensive Class III inventory on all projects involving surface disturbance; (2) monitoring surface disturbance (by a BLM approved archeologist) in areas where there is high probability of locating cultural resources; and (3) requiring the operator to suspend operations and notify GS and BLM if any resources are discovered.

Aesthetics

Visual Resources. Impacts to the visual resource result from manmade additions to or alterations of the natural landscape. Mitigation measures which may reduce the impact to the visual resource include: (1) following the natural contours wherever possible when building roads; (2) considering visual contrast when locating well sites; and (3) painting all semipermanent and permanent aboveground facilities with colors that will camouflage the facilities.

When determining whether a well site should be placed on top of a ridge or on a sidehill, an important consideration is whether the reduction of visual contrast outweighs the difficulty of rehabilitating the location, the loss of fill material, and increase in sedimentation, etc.

Noise. Oil and gas development leads to significant increases in noise levels. Where noise sources will be in place for many years, or where the noise would disturb nearby residents or alter the natural

characteristics of a recreation or special management area, muffling is an acceptable solution.

RESIDUAL IMPACTS

Air Quality

Implementation of all of the recommended mitigating or enhancing measures would reduce but not eliminate the adverse impacts on air quality from oil and gas operations. There would still be some gaseous pollutant degradation of air quality resulting from internal combustion engines, waste gas release, burning of sludge, hydrogen sulfide release, and any accidents such as fires or explosions.

Mineral Resources

An indeterminate amount of oil and gas would be removed. Construction of well sites and access roads would require the consumption of some aggregate resources (gravel, scoria, etc).

Topography

Dirt work, such as roads and well sites, would alter the topography. Some well sites in the area could never be recontoured to their predisturbance condition.

Soils

The more serious impacts that would occur in spite of mitigation are the clearing and movement of soil for access roads, and pipelines. Yet, with the prescribed mitigation measures for location and construction practices, these impacts could be reduced from a potentially severe to a moderate level over time. Rehabilitation periods range from 2 to 3 years for small buried pipelines to 10 to 50 years for production facilities needed during the productive life of the field.

Prescribed revegetation practices would further reduce long-term erosional impacts to minimal levels except where roads or other developments have been improperly located on unstable ground.

The residual impacts likely to persist despite mitigation are more difficult to assess in the case of accidents such as well blowouts, spills, leaks, or fires. Oil spills would generally have little impact directly on soil erosion. Their impact is contamination and subsequent loss of vegetation and soil microorganisms. Spills that cause vegetation loss would be somewhat short term due to the biodegradability of crude petroleum. Spills of salt solutions or other contaminants, and hot fires, may cause much longer periods of soil sterility with subsequent severe erosion on steeper sites.

Overall, unavoidable impacts from all phases of oil and gas production would tend to be moderate within the drainage areas in which fields are developed. However, there could be isolated instances of localized severe erosional impacts due primarily to large accidents; unsupervised, improper construction; or reclamation failures.

Water Resources

The residual impacts upon the water resources result from each of the discrete actions associated with oil and gas leasing. The most significant impacts during the drilling phase are related to erosion and sediment yield. It is felt that through effective implementation of recommended mitigation measures, erosion and sediment yield can be reduced substantially, resulting in minimal impacts. In some cases, after successful revegetation, erosion could actually be less than before the land disturbance.

The discrete impacts of many single wells within a watershed could have a cumulative effect which may result in permanent alteration of the hydrologic equilibrium. This alteration of the hydrologic equilibrium would be irretrievable. Alteration of the hydrologic equilibrium is the result of increases in peak flow caused by the clearing of land for drill pads and the construction of roads. The base level of streams could drop, causing headcutting and gully erosion. Channel stability and riparian habitat would be lost. As a result, aquatic and terrestrial wildlife habitat would be adversely impacted.

The recommended mitigating measures would almost entirely eliminate the possible impacts resulting from reserve pit fluids entering a live body of water.

Unavoidable impacts on surface water quality would be associated with accidents during the development and production phases. These include oil spills, leaks, and well blowouts. Contingency plans and safety measures such as protective dikes, standby clean-up equipment, etc., could

reduce impact in terms of both volume and length of exposure to pollution.

The utilization of water resources for oil and gas exploration and development could not be mitigated.

Stream crossings would inevitably produce suspended sediment. Constructing adequate stream-crossing structures and fords would increase suspended sediment during the construction phase. Unexpected or unusual peak flows may cause stream-crossing structures to fail. These climatic events may also cause reserve pits to overflow and the contents to enter stream channels. During heavy rains, failure of earthworks which contain production water may allow brine and oil to reach surface waters.

Vegetation

Vegetation would be lost due to the destruction of plant cover by the construction of well sites, access roads, pipelines, and other structures. A lesser impact would occur to off-site vegetation; i.e., vegetation immediately adjacent to the disturbed site. Impacts to this vegetation would be in the form of competition from species which invade the disturbed area, loss of habitat from erosion, soil compaction and siltation, or from mechanical injury by equipment.

Loss of vegetation could occur due to accidental well blowouts, fires, and spills of salt water or other toxic contaminants. Mitigating measures and cleanup contingency plans should minimize the extent of such occurrences. However, when these situations occur on much larger areas, vegetation can be lost for periods from one to several years in the case of fires or oil spills (in easily regenerated environments), to much longer terms in the case of soil sterilization.

Aquatic vegetation would be adversely impacted by siltation resulting from soil disturbance. The potential threat of a major oil spill reaching the streams and rivers would remain. Such a spill could adversely affect the aquatic flora to a significant degree.

Residual negative impacts during the exploration phase on timber production are generally minor and limited primarily to a temporary setback in timber production on relatively small areas. There is usually time to harvest timber from oil field sites prior to development and to rehabilitate and reforest such areas after abandonment, except in cases of severe accidental oil spills, saline water contamination, soil compaction, or loss of soil. Rehabilitation success varies between forest types, depending upon the actions applied, and it may not be possible to entirely restore some areas to their original productivity.

Wildlife

With judicious application of the various mitigation possibilities described for use in reducing wildlife impacts, a part of the negative impacts can be reduced. If recommended mitigation measures are accepted and thoroughly implemented, the following residual impacts on wildlife could still occur.

Poaching would continue to be a source of mortality to big game and many other animals. Increased access will result in migration of certain species out of an area due to human disturbance. Where accidental spills of oil or toxic substances occur there could still be losses, especially where the pollutants enter water sources. Fishes, amphibians, waterfowl, and aquatic mammals would be destroyed in these instances. In spite of precautions, some spills can be expected.

Where native vegetation is temporarily destroyed, the food and cover are also destroyed for a variety of species. The annual "crop" of these wildlife species would be eliminated or reduced until the habitat naturally comes back or is restored. Production of wildlife species dependent upon long-lived plants such as shrubs and trees would be eliminated or reduced for longer periods of time. It may take decades to reestablish adequate timber stands or browse communities.

Available habitat equal to the amount of acres disturbed (see Table II-3) becomes at least temporarily unavailable in the short term. Where concentrated development and human activity accompanies industry activity, habitat for certain species would be rendered useless over considerable acreages. Mitigation, which would help to ensure these developments take place in less important wildlife areas, would reduce negative impacts.

In abandonment available mitigation measures for vegetation rehabilitation should preclude any significant residual impacts except on the most sensitive sites or fragile areas. Light to moderate vegetation impacts could remain due to inadequate or the absence of rehabilitation measures. If crucial habitat areas are carefully considered and avoided whenever possible, the adverse impacts of oil and gas development would be minimized.

Livestock Grazing

Disruption of grazing on a short-term basis can be expected on all sites. Rangeland taken out of production (roads, drill pads, etc.) may be significant when it is of high productivity and oil and gas production extends over several years.

Except for large explosions, fire, spills of oil or other hazardous material, and severe compaction or loss of soil, the relative impact on a long-term basis is minimal.

Wild Horses

Wild horses would be disturbed to some extent by exploration activities and would be displaced for short periods. Horses would be affected by the vegetation loss caused by soil disturbance. The horses would benefit to some extent from the increased availability of water. An insignificant loss from traffic deaths associated with the oil and gas industry would be sustained.

Recreation

Residual impacts would be diminished enjoyment of recreation activity, increased access to recreation activity, and increased hazards to the health and safety of recreationists.

Cultural Resources

Impacts on the archeological resource that cannot be mitigated are those associated with surface disturbance. The threat of inadvertent destruction of undetected archeological, paleontological, or historical values would always remain despite clearance by skilled professionals. The opening up of previously inaccessible areas by road construction would also subject archeological, historical, and paleontological values to vandalism.

Aesthetics

Residual impacts would depend upon the effectiveness of site-by-site mitigating measures. Most structures, with the exception of utilities and other permanent structures, would be short lived, particularly those related to oil and gas development.

RELATIONSHIP BETWEEN SHORT-TERM USES AND LONG-TERM PRODUCTIVITY

Short-term use would consist of occupying the land for the purpose of production of oil and gas for a period of 1 to 50 years until the oil and gas supply is depleted to a point where it is no longer technically or economically feasible to produce. Long-term productivity is the continued use of the land by other activities such as grazing, wildlife use, and recreation. These uses are presently being made of the land and would continue after oil and gas production ceases, although they may be decreased.

Much of the land which is now committed solely to single use for oil and gas production would become available for other uses as wells are abandoned and rehabilitated. However, some of the permanent structures such as roads would not be removed and would continue to exist and impact the environment long after oil and gas production ceases.

The impact on air quality by gaseous pollutants would be relatively short term and would primarily exist only when oil and gas production is continuing. Revegetation/rehabilitation of well sites and other disturbed areas would result in a reduction of some of the dust pollution. However, some pollution by dust and gaseous emissions due to off-road vehicle travel related to increased access may continue after oil and gas production ceases.

Water quality would be affected similarly to air quality in that the impact on water would greatly decrease when oil and gas production ceases, but some water pollution would continue to occur through runoff from disturbed areas until those areas are successfully revegetated and stabilized. Toxic substances deposited in drainages would continue to pollute natural runoff for long periods of time.

Disturbance of land and placement of roads within a watershed changes the hydrologic equilibrium. Gully erosion as the result of stream crossings and other construction activities would lower water tables, alter riparian habitat, and significantly reduce watershed productivity.

As wells are abandoned, disturbed areas would be revegetated and returned to other uses. However, these sites may not return to the same level of productivity as before oil and gas production began. Some of the sites could possibly produce more vegetation and some would undoubtedly produce less. In most cases, these disturbed areas would

not be the same due to the availability of suitable seed types, difficulty of reestablishing some of the native species, and changes in soil composition which would permanently affect plant communities and succession.

Short-term use of the lands for general exploration activities would not, as a rule, impair long-term productivity for wildlife, with the exception of some endangered species. If oil and gas is found, however, subsequent development and production can have a long-term effect on wildlife through loss of crucial wintering, breeding, production, and migration areas. In these cases, both the habitat and wildlife can be lost. After production and site abandonment, the ecosystem may not be successfully restored. Human occupation that takes place during development and production may persist after petroleum production has been exhausted. Thus, wildlife formerly found in the area may never again use it, due to changes in land patterns and use, even though reclamation may be successful from another resource standpoint (i.e., vegetation, watershed, etc.).

Short-term use of oil and gas locations with cultural resources near them can sometimes be beneficial due to accelerated inventory, particularly in areas where little knowledge has been previously available. On the other hand, short-term use may represent the least efficient use of the cultural resource because of the state-of-the-art at the time of discovery and the "hurry-up" protection and salvage methods dictated. Short-term uses that alter or destroy cultural sites would, of course, have long-term impacts on the value of those resources.

Several beneficial long-term impacts can result from oil and gas activities, besides the obvious benefit from availability of petroleum products. The oil and gas industry lends stability to local economies. Increased access can be of benefit to ranching operations and to some recreationists. Many roads associated with the industry are maintained better than county roads. Useable water resulting from oil and gas exploration and development can benefit vegetation, wildlife, and ranching operations. Seeding locations in shrubby areas may increase the amount of "edge" habitat for wildlife. Introduction of electric power increases range improvement/development possibilities.

IRREVERSIBLE AND IRRETRIEVABLE COMMITMENT OF RESOURCES

The most apparent commitment of resources is the extraction and eventual consumption of oil and gas from the area. There is also a substantial amount of fossil fuel and electric power expended in all phases of oil and gas production.

Paleontological and archeological resources are subject to partial or total destruction by any surface or subsurface disturbance if they have not been identified and excluded or salvaged prior to construction. If salvage of these sites is done hastily, there is a chance that the maximum values of more deliberate work would not be attained.

The vegetation and animals lost due to oil and gas activities can, in theory, be replaced by rehabilitating the sites; however, the growth lost during the period when the site is not producing can never be replaced.

Excessive sedimentation can cause irretrievable changes in aquatic habitat when stream channels, lakes, marshes, or reservoirs become filled with sediment. These habitats no longer would be capable of producing the quantities of fish they once did, unless the sediment is physically removed, which is generally considered impractical.

Gullying and stream incision can also cause irretrievable changes in riparian habitat due to a drop in the ground water table. Lush riparian habitat favored by terrestrial wildlife and livestock would be lost.

Loss of soil due to severe erosion or contamination would represent irreversible losses. Due to accidents or reserve pit failures, the useful life span of small surface reservoirs could be reduced significantly through loss of storage capacity resulting from increased sedimentation. Ground water aquifers can suffer permanent loss of water quality if they become contaminated.

There are also irrevocable changes in surface resources, human interest values, and land use.

CHAPTER IV

CONSULTATION AND COORDINATION

TEAM ORGANIZATION

This environmental assessment (EA) was prepared at the BLM Rock Springs District Office by three-person team with the assistance of an interdisciplinary team. The core team was primarily responsible for preparing this document with technical input from various specialists. Table IV-1 lists the preparers of this EA.

PUBLIC PARTICIPATION AND SCOPING

This EA is not a separate process but rather an integral part of land use planning. Public participation has been encouraged throughout the planning pro cess. Oil and gas development has been the focal point for much discussion and input. Oil and gas industry representatives and opponents have provided much input into the Management Framework Plan (MFP) and related processes (WSAs, ACECs, etc). The MFP-2 recommendations for oil and gas in the Big Sandy and Salt Wells resource areas were presented to the public for review and comment at a public meeting held December 12, 1980, in Rock Springs, Wyoming. At this meeting, the purpose and tentative schedule for this EA were announced.

Later, when staffing and scheduling allocations were made, news releases were issued to the news media in the surrounding region, announcing the schedule and purpose of this EA. The releases also solicited questions and comments. Concurrently, personal letters were sent to interested organizations and individuals; informing them of the purpose and schedule, as well as soliciting their input.

CONSULTATION AND COORDINATION DURING PREPARATION OF THE ANALYSIS

The Geological Survey at Rock Springs, especially Environmental Specialist Chris Hanson, was consulted many times during the preparation of this document. The BLM Rawlins District Office was consulted concerning the Adobe Town area.

REVIEW OF THE DRAFT

If major revisions are not necessary, this EA could form Volume 1 of the final environmental assessment; thus, persons receiving the draft EA are encouraged to keep this document.

Draft EAs have been mailed to those agencies, individuals, organizations, and companies that have expressed an interest in oil and gas development in the assessment area. It has also been sent to those agencies with known interests in such development. The following list does not include all receiving the draft, but it is intended as a representative listing of those interested parties:

Federal Agencies

Bureau of Reclamation
Fish and Wildlife Service
Forest Service
Geological Survey
Soil Conservation Service
Tennessee Valley Authority
U.S. Senators Alan Simpson
and Malcolm Wallop
U.S. Congressman Dick Cheney

State Agencies

Governor's Office
Planning Coordinator's Office-State Clearing House (Distributes to State Agencies); also, by request to:
Wyoming Game and Fish Department
Wyoming Geological Survey

Table IV-1

LIST DF PREPARERS

Name	EA Assignment	Position/Expertise	Education	Experience
Charles E. Reed	Team Leader	Chief, Rock Springs Division of PIanning and Environmental Coordination	B.S. Animal Science, SuI Ross State University	4 years BLM; l year Forest Service; lO years BIA
Jared Brandwein	Core Team (All Resources)	Big Sandy Area WIldlife Management Biologist	A.B. Biology, Ripon (Wisconsin) College	l 1/2 years BLM; 1 1/2 years Forest Service; 2 years Peace Corps
Linda S. Deuell	Core Team (Writer-Editor)	District Writer-Editor		5 1/2 years BLM
Anita M. Todd	Word Processing Lead[1/]	AmText 425 Operator/Mag Card II Typist	1 year College of Southern Idaho	3 years BLM
Peggy A. Dabb	Word Processing Lead [1/]	AmText 425 Operator/Mag Card II Typist		1 1/2 years Internal Revenue Service and Army; 2 years BLM
Walt George	Rawlins District Coordination	District Environmental Specialist	B.S. Wildlife Biology, Humboldt College; M.A. Ecology, University of Minnesota	3 years Oepartment of Transportation; 1 year BLM
Mike Karbs	Rawlins Oistrict Coordination	Planning and Environmental Coordination Manager	B.S. Mineral Engineering, Colorado School of Mines	7 years BLM; 2 years private industry
Vernon Lovejoy	Rawlins District Coordination	District Dutdoor Recreation Planner	B.A. Physical Geology, University of Charleston (West Virginia); M.A. Outdoor Recreation and Park Administration, Eastern Kentucky	5 years BLM; 2 years Army Corpa of Engineers
Eugene Jonart	State Dffice EA Coordination	Wyoming State Dffice Environmental Coordinator	B.S. Forest and Range Management, University of Montana	14 years BLM
Richard L. Hopkins	State Dffice Technical Coordination	Wyoming State Dffice Natural Resource Specialist	B.S. Range Science, Colorado State University	13 years BLM
Renee Oana	Rock Springs District Coordination[2/]	District Environmental Coordinator	B.S. Range Management, University of Wyoming	7 years BLM
Ann B. Aldrich	Rock Springs District Coordination; Vegetation, Rehabilitation[2/]	District Botanist/Acting Environmental Coordinator	B.S. Botany, University of Michigan	2 1/2 years BLM
Jon M. Dolak	Ssit Wells Area Coordination	Area Realty Specialist	B.S. Forestry and Range Management, Colorado State University	12 1/2 years BLM
Sally Haverly	Big Sandy Area Coordination	Area Realty Specialist		5 years BLM; 23 1/2 Air Force
DonaId L. Dutcher	Visual Resources	Oistrict Environmental Specialist	B.A. Liberal Arts, Whitman College; M.A. Public Administration, University of Dklahoma	2 1/2 years BLM; 8 years HUD
Ronald C. Herdt	Special Assistance	District Technical Writer-Editor	B.A. Secondary Education, University of Northern Colorado	4 1/2 years BLM; 6 years University of Colorado
Renee LsViolette	Soils[3/]	District Soil Scientist	B.S. Soil Science, University of Wisconsin	2 years BLM
Colin W. Voigt	Soils[3/]	District Soil Scientist	B.S. Agronomy, University of Kentucky	3 years BLM
Dean Stilwell	Geology	Diatrict Geologist	B.S. and M.S. Geology, University of Nebraska	1 1/2 years BLM
John S. Young	Socioeconomics	Regional Economist	B.S. Animal Science and M.S. Agricultural Systems, Colorado State University	1 year BLM; 1 1/2 years CSU

1/Ms. Oabb replaced Ms. Todd as Word Processing Lead on the EA.

2/Ms. Aldrich replaced Ms. Oana as Environmental Coordinator on the EA.

3/Mr. Voigt replaced Ms. LaViolette as Soils Scientist on the EA.

Wyoming Oil and Gas Commission
Wyoming State Land Use Council
Wyoming Travel Commission
State Representatives Jim Roth, Jack Pugh, and Ann Strand
State Senators Ford Bussart, Steve Majhanovich, and Hight Proffit

Local Government

Green River City Engineer
Green River Planning Board
Lincoln-Uinta County Association of Governments
Mayor of Green River
Mayor of Rock Springs
Mayor of South Superior
Mayor of Wamsutter
Rock Springs City Engineer
Rock Springs City Planner
Sublette County Commissioners
Superintendent of District 1 Schools
Superintendent of District 2 Schools
Sweetwater County Association of Governments
Sweetwater County Commissioners
Sweetwater County Engineer
Sweetwater County Priorities Board
Wyoming Association of County Agricultural Agents
Wyoming Association of County Commissioners
Wyoming Association of Municipalities

Educational Organizations

University of Wyoming
Department of Range Management
Institute for Policy Research
Water Resources Research Institute
Colorado State University
Farson-Eden School

Other Organizations

Association of Geophysical Contractors
Defenders of Wildlife
Environmental Defense Fund
Green River Chamber of Commerce
League of Women Voters of Sweetwater County
Lincoln County Historical Society
National Audubon Society
National Outdoor Leadership School
National Wildlife Federation
Natural Resources Defense Council
Northern Plains Resource Council
Old West Regional Commission
Petroleum Association of Wyoming
Rock Springs Gem and Mineral Club
Seedskadee Audubon Society
Sierra Club
Southwest Wyoming Industrial Association
Sweetwater County Historical Society
Sweetwater County Outfitters Association
Sweetwater Wildlife Association
Teton Village Resort Association
Wildlife Management Institute
Wyoming Farm Bureau Federation
Wyoming Natural Heritage Program
Wyoming Public Lands Council
Wyoming Wilderness Association
Wyoming Wildlife Federation
Wyoming Wool Growers Association
YWCA of Sweetwater County

Private Interests

American Energy Exploration
Amoco Production Co.
ARCO
Frank E. Basil, Inc.
Beard Oil Co.
Black Butte Coal Co.

Brown and Root, Inc.
Buckhorn Petroleum Co.
Jerry Chambers-Oil Producer
Champlin Petroleum Co.
Chevron U.S.A., Inc.
Church and Dwight Co., Inc.
Coastal Oil and Gas Corp.
Colorado Interstate Gas Co.
Conoco, Inc.
Consolidation Coal Co.
Cumberland Coal Co.
Davis Oil Co.
DEDCO
Diamond Shamrock Corp.
Energy Reserves Group
Eureka Energy Co.
Evergreen Enterprises
FMC Corporation
Gulf Oil Corp.
Robert Hawkins
Kerr-McGee Coal Corp.
Peter Kiewit Sons and Co.
Koch Exploration Co.
MAPCO
Marathon Oil Co.
Mobil Oil Corp.
Mountain Fuel Supply Co.
NERCO, Inc.
Northern Minerals Co.
Northwestern Exploration Co.
Odessa Natural Corp.
Pan Canadian Petroleum Co.
Peabody Coal Co.
Petroleum Inc.
Petro-Search, Inc.
Philadelphia Quartz Corp.
Phoenix Resources Co.
Prenalta Corp.
Regulus Corp.
Rocky Mountain Energy
Shell Oil Co.
Stansbury Coal Co.
Stearns-Rogers Engineering Corp.
J. Paul Storrs
Tenneco Oil Co.
Teton Exploration Drilling Co., Inc.
Texaco, Inc.
Texas, Inc.
Texas Oil and Gas Corp.
Tosco Corp.
Uinta Development Co.
Union Energy
Union Oil Company of California
U.S. Steel Corp.
Utah International, Inc.
Vulcan Materials Co.
Wexpro Co.

Other Interested Groups, Persons

Environmental Impact Service
Envirosphere Co.
Green River Star
Federal Land Bank Association of Wyoming
Steve Kenney
Finis Mitchell
Mountain Bell
Pacific Power and Light Co.
J. B. Peterson
Calvin Ragsdale
Craig Thompson
Union Pacific Railroad Co.
Utah Power and Light Co.

A limited number of draft EAs are available upon request from the BLM Division of Planning and Environmental Coordination, Rock Springs District Office.

Copies of the draft were also made available for public review at public libraries in Green River, Rock Springs, and Superior, Wyoming.

APPENDIX A

OIL AND GAS DEVELOPMENT AND OPERATING PROCEDURES

GEOPHYSICAL EXPLORATION

Geology

Hydrocarbons occur in association with water, in porous sedimentary rocks such as sandstone. Since petroleum and natural gas are less dense than water, they rise until trapped by a barrier, usually an impermeable rock layer. Oil and gas fields in the area are of two types: anticlinal (convex upward) fold and stratigraphic trap (Figure A-1). The most important hydrocarbon-bearing formations in the assessment area are sandstones, particularly the Frontier Formation (Cretaceous) and the Weber Formation (Pennsylvanian).

Methods

The likelihood of the presence of oil and gas is often determined by geological prospecting. Such prospecting can be done on the ground, where off-road vehicle travel may be necessary, or by aerial survey. Photographs from orbiting satellites have also been used to identify surface structure.

Subsurface geology is not always accurately indicated by surface outcroppings. To prove surface indicators and to map the subsurface structures, geophysical exploration is used. There are three types of geophysical exploration: gravitational field, magnetic field, and seismic characteristics.

Gravitational prospecting detects variations in gravitational attraction caused by the differences in the density of various types of rock. Magnetic prospecting often replaces or is used to supplement gravitational work. Magnetic methods reveal buried structures (likely to yield oil and gas) because such structures show a strong magnetic response. Gravitational and magnetic prospecting equipment is usually transported by pickup or helicopter. The only surface disturbance is that caused by the vehicle.

Seismic prospecting is the most popular of the geophysical methods, since it gives the most reliable and reproducible results. Shock waves are initiated using a thumper or vibrator on the surface, or explosives in the bedrock. The waves travel through or are reflected from various rock layers, and are received by shock sensors. The sensors are connected to a truck where the shock waves are recorded. The time required for shock waves to travel through the rock formations yields useful information.

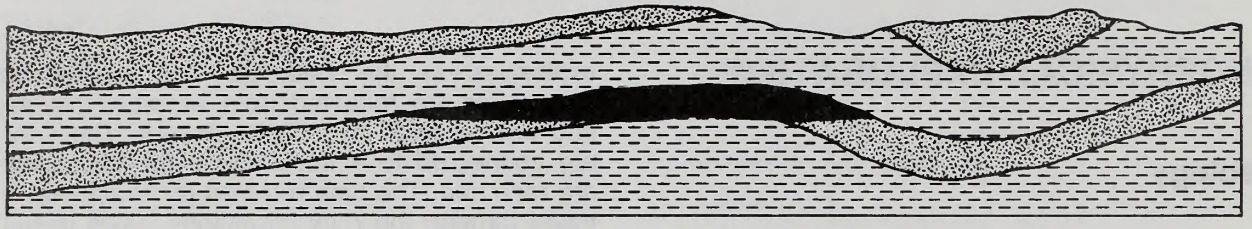
In the explosive method, shot holes, approximately 6 inches in diameter, are drilled to a depth of 50 to 200 feet. Four to twelve holes are drilled per mile of line. The holes are loaded with 5 to 50 pounds of explosives and detonated.

The thumper and vibrator methods pound or vibrate the earth to create a shock wave. Vibrator methods are widely used and are replacing the drill and shot method. Usually four large trucks are used, each equipped with vibrator pads (about 4-feet square). The pads are lowered to the ground and vibrators on all trucks are triggered electronically from the recording truck. Information is recorded and then the trucks move forward a short distance and the process is repeated. Less than 50 square feet of surface area are required to operate the equipment at each test site.

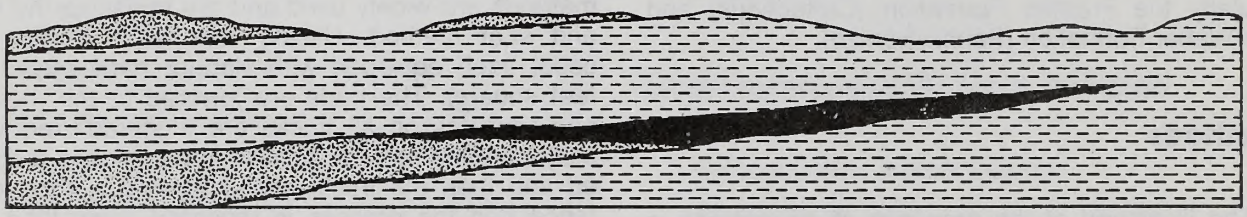
In remote areas where there is little known subsurface data, a series of short seismic lines may be required to determine the regional dip and strike of subsurface formations. After this, seismic lines will be aligned with these formations to make seismic interpretation more accurate. The seismic sensors and energy source are located along lines on a one- to two-mile grid. Although alignment may be fairly critical, spacing of the lines can often be changed 0.25 mile on a one-mile grid before the results will affect the investigation program.

A typical drilling seismic operation may utilize ten to fifteen men operating five to seven trucks. Under normal conditions, three to five miles of line can be surveyed each day using the explosive method. The vehicles used for a drilling program include several heavy truck-mounted drill rigs, water trucks, a computer recording truck, and several light pickups for the surveyors, the shot-hole crew, the geophone crew, the permit man, and the party chief.

Public roads and existing private roads and trails are used. Off-road cross-country travel is also necessary. Motor graders and/or dozers may be required to provide access to remote areas. Several



ANTICLINAL FOLD TRAP



STRATIGRAPHIC TRAP

SOURCE: BLACKSTONE, 1971

Impermeable Shale

Oil

Permeable Sandstone

Figure A - 1
Structural Traps for Crude Oil and Natural Gas

trips a day are made along a seismograph line; this usually establishes a well defined two-track trail. Drilling water, when needed, is usually obtained from private landowners or local city officials.

Responsibilities

The Mineral Leasing Act provides that all public lands are open to oil and gas leasing unless a specific land order has been issued to close the area. Geophysical exploration (preliminary exploration) can be conducted on all public lands open to oil and gas leasing.

The federal regulations (43 *CFR* 3045) for oil and gas exploration activities require cooperation between the BLM District Manager, his staff, and geophysical operators. BLM does not require a permit for geophysical operations, but it does require a permit before earth-moving equipment and snow removal equipment can be used on public lands.

The geophysical industry and BLM mutually developed standards that operators will follow when conducting geophysical operations on public lands. These standards are outlined in BLM Wyoming Manual Supplement 3045. The geophysical operator has a responsibility to cooperate and coordinate his operations with the BLM District Manager.

Notices of Intent for geophysical exploration are required for all lines (in their entirety), if any portion of the lines cross federally owned surface. Notices of Intent are to be filed and processed according to the requirements of 43 *CFR* 3045 and Wyoming State Office Supplement 3045. The steps required of the operators and the BLM are described in *Oil and Gas: Surface Operating Standards for Oil and Gas Exploration and Development*, second edition, prepared by the BLM, Geological Survey (GS), and Forest Service (August 1978). The Notice of Intent (Terms and Conditions, Item 7) provides BLM with the opportunity to attach reasonable stipulations. BLM checks for compliance with stipulations for portions of the line on federal surface.

The action cannot be denied, except in wilderness study areas and then only if the action will impair the wilderness values. The only alternative is to persuade the operators to alter proposed seismic routes or lines, if there is a conflict with critical resources.

LEASING

The actual leasing of an area is an administrative action and, in itself, causes no impact. However, the issuance of a lease authorizes the lessee to actively explore and develop the lease, guided by the stipulations attached to the lease. The importance of stipulations that are attached to the lease should be stressed. They are attached to the lease when the lessee accepts it and serve to point out areas of special environmental concern.

Oil and gas leases fall into two categories—competitive and noncompetitive. Competitive leases are for lands inside Known Geologic Structures (KGS) which are determined by GS. A KGS is technically the geologic trap in which a productive accumulation of oil or gas has been discovered by drilling. The limits of the KGS include all acreage that is presumably productive. The public may request that KGS land be offered for competitive leasing; GS prepares a report on KGS status, recommends whether or not competitive leasing is in the public interest, and nominates tracts to be grouped in lease parcels. If leasing is recommended by GS, land nominated by the public is combined with GS nominations (in active KGS areas), the BLM district office is consulted to determine if there are any land use conflicts, and a competitive lease sale is scheduled. BLM conducts the lease sale and sealed bids are accepted for each tract. For each bid deemed adequate and accepted, a lease is issued, and the lessee is required to pay a cash bonus. Competitive leases are issued for a term of five years or as long as oil is produced. By federal regulation, the acreage may not exceed 640 acres.

Noncompetitive leases are for lands outside a KGS. Noncompetitive leases are of two types—those that appear on the simultaneous list and those that are open land offers.

These parcels are listed bimonthly as they become available, following termination of the old leases. The BLM district office makes recommendations as to land use suitability and attaches indicated stipulations (Appendix C). Once a list is approved and advertised, all applications received during the filing period are considered to have been filed simultaneously. An applicant may file only one application per tract. A lottery-type drawing is held and one application is drawn for each tract.

If there are no applications for a tract, it becomes an open land offer and is available to the first applicant subsequent to the drawing. Noncompetitive leases are issued for ten years or as long as oil is

produced. By federal regulation, the acreage may not exceed 10,240 acres.

Rent payment in advance, plus royalties based on production, are required on all leases. Rent on noncompetitive leases is $1.00 an acre per year. Upon production of oil and gas, the royalty is 12.5 percent. Rent and royalties on competitive leases are prescribed in the lease terms. Prior to issuance of either competitive or noncompetitive leases, the lessee must post a surety bond to ensure compliance with lease stipulations.

Responsibilities

All oil and gas leases, whether competitive or noncompetitive, are processed through the BLM Wyoming State Office (WSO). The respective Resource Area Manager is the District Manager's representative for prelease investigations and recommendations in the affected area.

The lease offers are sent to the resource area for comparison with planning decisions and assignment of resource protection stipulations or no-leasing recommendations; they are then returned to WSO for issuance or drawing.

When a proposed oil and gas lease is received at the resource area, there are two alternatives available: recommend leasing with the attachment of special stipulations, or recommend no leasing.

Stipulations

Stipulations attached to leases are determined on the basis of the BLM Manual, WSO instructions, Management Framework Plan (MFP) decisions, and, in some cases, field examinations. Current MFP decisions are described in Chapter I, Description of Alternatives Including the Proposed Action.

Ten standard stipulations and a "wilderness stipulation" have been agreed to by BLM and GS for attachment to oil and gas leases (see Appendix C). Use of those standard stipulations pertaining to no surface occupancy requires GS concurrence, as does use of any nonstandard stipulations.

When the potential impacts from oil and gas exploration or development cannot be mitigated and the surface values are judged to be greater than the potential oil and gas resource, no surface occupancy is allowed. The no-surface occupancy stipulation is to be used only on leases or portions of leases that are 0.5 mile or less in width from the nearest place acceptable for occupancy.

It is assumed directional drilling can be utilized to tap an oil or gas pool within the no-surface-occupancy zone. However, the feasibility of directional drilling is dependent on geological structure and rock composition, and must be determined by the operator. (The difference between directional drilling and conventional drilling consists of the directional drilling assembly that is attached to the drill pipe. Directional drilling adds expense to drilling costs by requiring special equipment and personnel, as well as a greater length of drilling time, such as 60 days on a well that would normally take 30 days.)

No Leasing

The area manager can recommend no leasing for all or portions of oil and gas lease tracts that are farther than 0.5 mile from any place of acceptable occupancy, because the oil and gas reserves cannot be tapped by directional drilling. Any such "no lease" recommendation must be pursued through the BLM planning process and must consider an inventory of the oil and gas resource on the lease in question (Wyoming State Office Instruction Memorandum No. WY-80-290.)

Administration of Existing Leases

After an oil or gas lease has been issued, the lessee has up to five or ten years, depending on the type of lease, to start actual drilling operations, or the lease will be terminated. An extension of two years may be granted if actual drilling operations are commenced prior to the end of the primary term of the lease and are being diligently pursued over the expiration date. A lease remains valid as long as oil or gas is produced in paying quantities.

After a lease has been issued and while it is in effect, there is no opportunity to attach more resource protection stipulations to the lease proper. The BLM has no alternative but to allow lessees to exercise their right to drill for oil or gas on existing leases.

However, protection is afforded to identified resources at several different times throughout the lifespan of specific surface-disturbing activities on the lease. The BLM has surface management responsibilities for all oil and gas activities concerning federally owned oil and gas, whether the surface estate is privately owned or under the jurisdiction of the BLM. All proposed drilling operations and related surface-disturbing activities must be approved before entry upon the lands involved. The activities are approved by GS, with BLM providing resource protection stipulations.

EXPLORATION AND DEVELOPMENT

A federal lessee or operator is governed by procedures set forth by the Notice to Lessees and Operators of Federal and Indian Onshore Oil and Gas Leases (NTL-6). NTL-6 lists the following as pertinent points to be followed by the lessee or operator: preliminary environmental review (PER); application for permit to drill (APD), which includes a multi-point surface use and operations plan; approval of subsequent operations; agreement for rehabilitation of privately owned surface; well abandonment; and water well conversion (see *Surface Operating Standards for Oil and Gas Exploration and Development*). Lessees or operators must also apply for rights-of-way if they construct transportation or utility lines across federal surface. These points are addressed in more detail below.

Preliminary Environmental Review (PER)

The federal lessee or operating company selects the location of a proposed drill site. The selection of the site is based on spacing requirements, the probability of finding hydrocarbons as indicated by geologists and geophysicists, the topography, and the availability of funds for a specific well. Spacing requirements are established by the Wyoming State Oil and Gas Commission. Each well is to be drilled within a given distance from the center of a subdivision (such as a quarter/quarter of a section or a quarter section, depending on the spacing assigned to the particular area). A proposed location may be moved within the tolerance or (with a spacing exception obtained from the Oil and Gas Commission) outside the designated tolerance. Occasionally, GS may request that a lessee drill a well on the lease if it is determined that federally owned minerals are being drained by an adjacent well on private or state owned minerals.

After a company makes the decision to drill a well, they submit maps and letters indicating their intent to BLM and GS. This normally occurs prior to surveying and staking. The company must also receive permission to drill from the Wyoming Oil and Gas Commission

BLM checks the proposed drilling location against the oil and gas stipulations overlay (see Maps A-1A and A-1B) for conflicts with critical resources. If there are no critical areas indicated, permission is given to survey the proposed location and to proceed with the requirements of NTL-6.

Several options are available if proposed oil or gas activity is in conflict with critical resources or areas as identified by the resource area.

1. Grant verbal permission to survey with the understanding that the site may require relocation, and conduct a field inspection prior to staking to evaluate impacts to critical resources. The identified impacts will then be considered by the operator when preparing the multi-point surface use plan that accompanies the APD.

2. Consult with the Fish and Wildlife Service if it is determined that drilling activities could jeopardize the existence or modify essential habitat of any federally listed threatened or endangered species.

3. Prepare a point-specific EA or EIS for any proposed location that is within a wilderness study area.

Conducting an on-the-ground inspection in conjunction with a PER requires travel over public roads, private roads, and trails, as well as off-road cross- county travel. This travel takes place even though weather and travel conditions may be inclement.

A PER is required for both oil field development wells and wildcat exploration wells. Due to the potential for future conflicts with resources, which may be unknown when PER clearance is given, the PER is only cleared for six months. If the clearance is not exercised and an APD is not filed within the six month time period, another PER must be filed before the company drills at the location.

Surveying

Surveying a proposed well site requires travel over public roads, private roads and trails, and off-road cross-county travel. Since drilling oil and gas wells in the area is a year-round activity, surveying and, therefore, travel is necessary under all weather conditions. A proposed well location must be surveyed from an established section corner.

Application for Permit to Drill (APD)

After the PER process has been accomplished and before any surface activity is conducted in conjunction with the drilling of an oil or gas well, the operator must submit to GS an APD and an agreement with the surface owner, if the land surface is privately owned. (The surface owner agreement lists the surface owner's rehabilitation requirements. These requirements, if deemed appropriate

by GS and BLM, are considered to be stipulations to the plan. If a surface owner requests measures which may be harmful to the environment or unreasonable, every possible effort is made to negotiate alternate measures.)

The APD is forwarded by GS to the BLM Rock Springs District, Division of Operations. The APD is also used as the right-of-way application for the off-lease facilities included in the transmittal. A field inspection with representatives of GS, BLM, lessee or operator, and any other interested party (such as the dirt contractor or surface owner) is held. The presite field inspection entails travel on public roads, private roads, and trails, and off-road cross-county travel with pickups and, at times, snow machines. Helicopters are occasionally used.

The purpose of the presite field inspection is to evaluate the operator's plan, to assess the situation for possible impacts, and to formulate resource protection stipulations. To lessen environmental impacts, a site may be moved, reoriented, or redimensioned, within certain limits, at the presite inspection. The proposed access road may also be rerouted.

Stipulations are sent to GS as conditions of approval for a well site. At this time, if the proposed well is on federally owned surface under the jurisdiction of the BLM, BLM states whether or nor it wishes to acquire the oil or gas well for a water well at the time of abandonment.

Prior to approval of an APD, an archeological clearance must also be obtained by the operator.

GS is responsible for preparing an environmental assessment prior to the approval of an APD. The final approval of an APD is given by GS, and the operator may commence construction activities. Approval of an APD is valid for one year. If construction does not begin within one year, the stipulations must be reviewed prior to approving another APD.

After an application for permit to drill (APD) is approved, GS assigns an area of operation (AO) to each well. For exploratory wells, the AO assigned to an oil well is 160 acres, and to a gas well is 640 acres. The AO for wells within a producing field is determined by the productive capacity of the reservoir and, if necessary, the spacing unit for the field.

All activities within an AO carried out in conjunction with an oil or gas well are approved and enforced by GS with input by BLM. All activities (e.g., rights-of-way and temporary use permits for access roads and pipelines, etc.) that cross federally owned surface outside the lease are the responsibility of BLM.

Issuance of Rights-of-Way

Rights-of-way are required for all facilities, tank batteries, pipelines, truck depots, powerlines, and access roads that occupy federally owned land outside the lease or unit boundary. When a third party (someone other than the oil or gas company and the federal government) constructs a facility or installation on or off the lease, a right-of-way is also required. The right-of-way is issued by BLM. Standard stipulations for rights-of-way have been established for the entire state by the BLM Wyoming State Office (WY-81-413, August 19, 1981).

Drilling Operations

Exploratory Drilling

Every oil or gas field in the area started with an exploratory well. Approximately 30 wildcat wells are drilled in the assessment area each year in search of oil and gas. Of this amount, approximately 26 percent are productive.

Upon receiving approval to drill the proposed well, the operator moves construction equipment over existing roads to the point where the access road will begin. Generally the types of equipment include dozers (track-mounted and rubber-tired), scrapers, and motor-graders. Moving equipment to the construction site requires moving several loads (some overweight and overwidth) over public and private roads. Existing roads and trails are improved in places and occasionally culverts and cattleguards are installed if required.

The length of the access road varies. Generally the shortest feasible route is selected to reduce the haul distance and construction costs. Environmental factors or the landowner's wishes may dictate a longer route. In rough terrain, the type of construction is sidecasting (using the material taken from the cut portion of the road to construct the fill portion); slightly less than one-half of the road bed is on a cut area and the rest is on a fill area. Roads are usually constructed with a 18-foot-wide running surface (in relatively level terrain). Soil texture, steepness of the topography, and moisture conditions may dictate surfacing the access road in some places, but generally not for the entire length. The total acreage disturbed for each mile of access road that is constructed varies significantly with the steepness of the slope (see Table II-2).

Well locations are constructed by one of three different general types of construction, but in every case, all soil material suitable for plant growth is

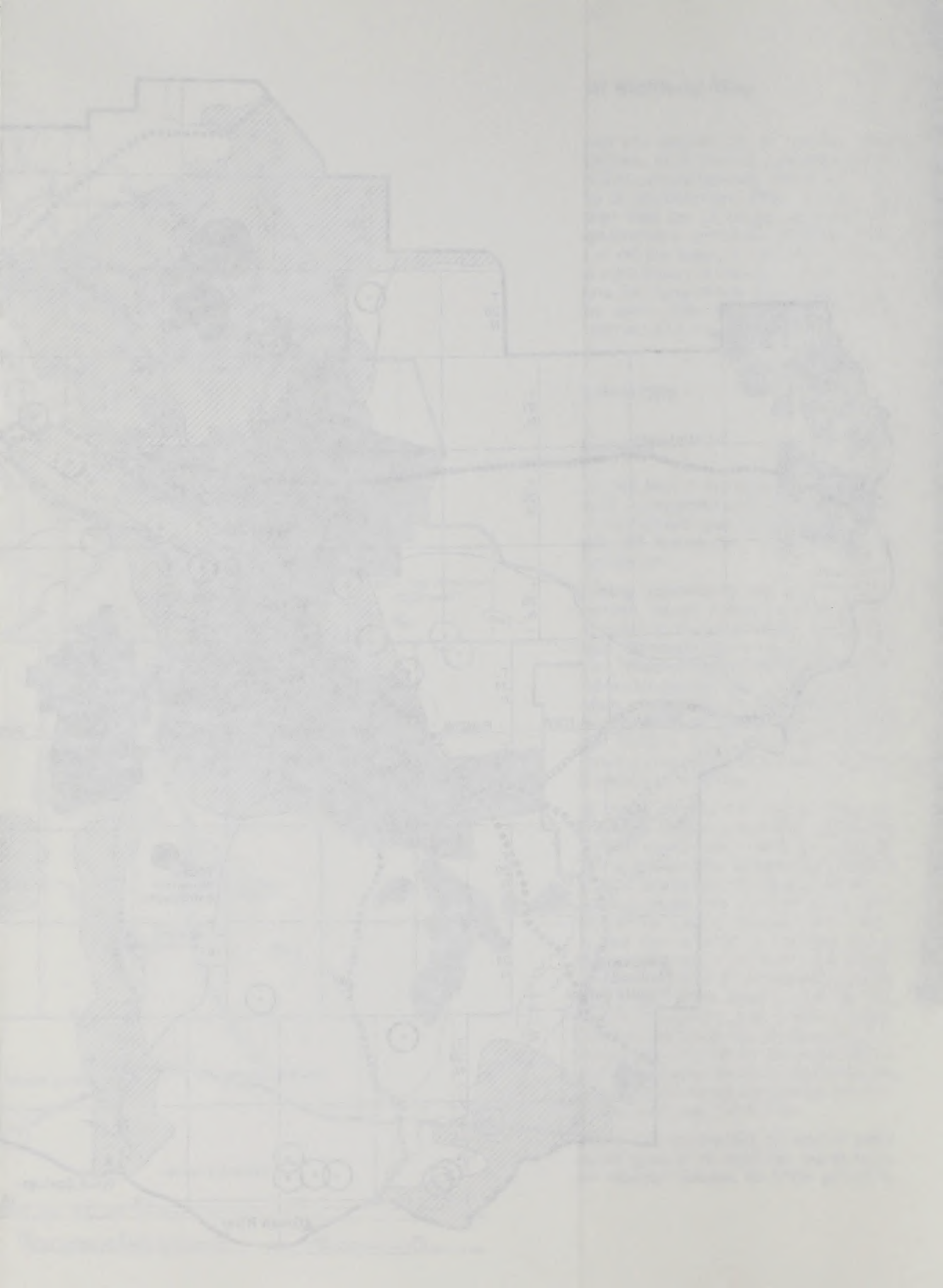
N

Critical Watershed Areas
Wilderness Study Area
Areas of Critical Environmental Concern
Crucial Wildlife Winter Range
Sublette Cutoff
Emigrant Trail
Slate Creek Cutoff
Kinney Cutoff
Lander Cutoff
South Pass-Point of Rocks Stage Road
Bryan-South Pass Stage Road
Eligible National Register Sites
Sage Grouse Strutting Grounds

Map A-1A
EXISTING OIL AND GAS STIPULATIONS
BIG SANDY RESOURCE AREA

BIG SANDY – SALT WELLS
OIL AND GAS LEASING
ENVIRONMENTAL ASSESSMENT

Scale: 1:500,000
10 0 10 20 Miles
10 0 10 20 30 Kilometres



Cherokee Trail
Overland Stage Road
Wilderness Study Areas
Areas of Critical Environmental Concern
Crucial Wildlife Winter Range
Eligible National Register Sites
Sage Grouse Strutting Grounds

N

Thayer Junction
Point of Rocks Stage Station
Rock Springs
Green River
Black Buttes
Black Buttes Stage Station
LaClede Stage Station
Fort LaClede
Dug Springs Station
Flaming Gorge National Recreation Area
Pine Butte ACEC
Adobe Town
Devils Playground
Pine Spring ACEC
Twin Buttes
Flaming Gorge Reservoir
Red Creek
Uinta County
Sweetwater County
Little Bitter Creek
Bitter Creek
Salt Wells Creek
Blacks Fork
Green River
Hams Fork
Sage Creek
Currant Creek
Vermillion Creek
Atkinson Creek
I-80
430
530
373
T. 20 N.
T. 19 N.
T. 18 N.
T. 17 N.
T. 16 N.
T. 15 N.
T. 14 N.
T. 13 N.
T. 12 N.
R.114W.
R.113W.
R.112W.
R.111W.
R.110W.
R.109W.
R.108W.
R.107W.
R.106W.
R.105W.
R.104W.
R.103W.
R.102W.
R.101W.
R.100W.
R.99W.
R.98W.
R.97W.
R.96W.

Scale: 1:500,000

10 0 10 20 Miles

10 0 10 20 30 Kilometres

Map A-1B
EXISTING OIL AND GAS STIPULATIONS
SALT WELLS RESOURCE AREA
BIG SANDY – SALT WELLS
OIL AND GAS LEASING
ENVIRONMENTAL ASSESSMENT

first removed from areas to be disturbed and stockpiled in a designated area. Sites on flat terrain usually require little more than removing the topsoil material and vegetation. Drilling sites on ridge tops and hillsides are constructed by cutting and filling portions of the location. The majority of the excess cut material is stockpiled in an area that will allow it to be easily recovered for rehabilitation. It is important to confine extra cut material in a stockpile rather than cast it down hillsides and drainages where it cannot be recovered for rehabilitation.

The amount of level surface required for safely assembling and operating a drilling rig varies with the type of rig, but averages 300 feet by 350 feet. Figure A-2 illustrates a typical well location layout. At least 25 feet is required to be on an area of cut instead of fill, between the drill point and the outer edge of the drilling platform. This ensures that the foundation of the drilling derrick is on solid ground and prevents it from leaning or toppling due to settling of uncompacted soil.

In addition to the drilling platform, a reserve pit is constructed, usually square or oblong, but sometimes in another shape to accommodate topography. Generally, the reserve pit is 8 to 12 feet deep, but may be deeper to compensate for smaller length and width or deeper drilling depths.

Depending on the relation of the location to natural drainages, it may be necessary to construct water bars or diversions. The area disturbed for construction and the potential for successful revegetation depends largely on the steepness of the slope.

Usually drilling activities begin within a week or two after the location and access road have been constructed. The drilling rig and associated equipment are moved to the location and erected. Moving a drilling rig requires moving 10 to 25 truck loads (some over legal weight and height) of equipment over public highways and private roads. The derrick when erected is approximately 160 feet high.

Water for drilling is hauled to the reserve pit or transported by surface pipeline. Water sources are usually rivers, wells, or reservoirs. Occasionally, water supply wells are drilled on or close to the site. The operator must obtain a permit from the Wyoming State Engineer for the use of surface or subsurface water for drilling. When BLM holds the water permits for surface water (stock ponds), BLM must also approve such use. When drilling commences and as long as it progresses, water is continually transported to the reserve pit. Approximately 40,000 barrels or 1,680,000 gallons of water are required to drill an oil or gas well to the depth of 9,000 feet. More water is required if the underground structure is fractured enough to permit water to escape into it.

Starting to drill is called "spudding in" the well. The initial drilling through shallow formations proceeds rapidly, and generally a string of surface casing is set before harder, deeper formations are encountered. The surface casing is a long length of steel pipe which is cemented into the well to protect against water or rock getting into the well. It is large enough to allow subsequent lengths of casing to be set as the well is drilled deeper. (Prior to drilling, operators must identify any water wells within one mile of the drill site. If any exists within 0.5 mile, the drill hole must be cased and cemented to a depth below that of the aquifers supplying the well(s) to prevent contamination.)

Drilling is accomplished by rotating a special bit under pressure. The combination of rotary motion and pressure causes rock to be chipped away at the bottom of the hole. The rotary motion is caused by a square or hexagonal rod, called a kelly, which fits through a square or hexagonal hole in a large turntable, called a rotary table. The rotary table sits on the drilling platform and, as the hole advances, the kelly slides down through it. When the kelly has gone as deep as it can, it is raised, a piece of drill pipe is attached in its place, the drill pipe is lowered, the kelly is attached to the top of it, and drilling recommences. By adding more and more drill pipe, the hole can steadily penetrate deeper.

Eventually, the bit becomes worn and must be replaced. Then the entire string of drill pipe must be pulled from the hole, in sections, until the bit is out. The bit is replaced and then the drill string is reassembled and lowered into the hole, section by section, and drilling is started again. This process of removing and reinserting the drilling string uses much of the time required in drilling.

Drilling mud is circulated through the drill pipe to the bottom of the hole, through the bit, up the bore of the well, through a screen which separates the rock chips, and into a holding tank from which it is pumped back into the well. The mud is maintained at a specific weight and thickness to cool the bit, reduce the drag of the drill pipe on the sides of the well hole, seal off any porous formation, contain formation fluids to prevent a blowout or loss of drilling fluid, and bring the rock chips to the surface for disposal. Various additives are used in maintaining the drill mud at the appropriate viscosity and weight. Some of the additives are caustic, toxic, or acidic, but these are rarely used.

Drilling operations are continuous, 24 hours a day and 7 days a week. The duration of drilling is between 60 and 90 days for a 9,000 foot well unless drilling problems are encountered. Deeper wells

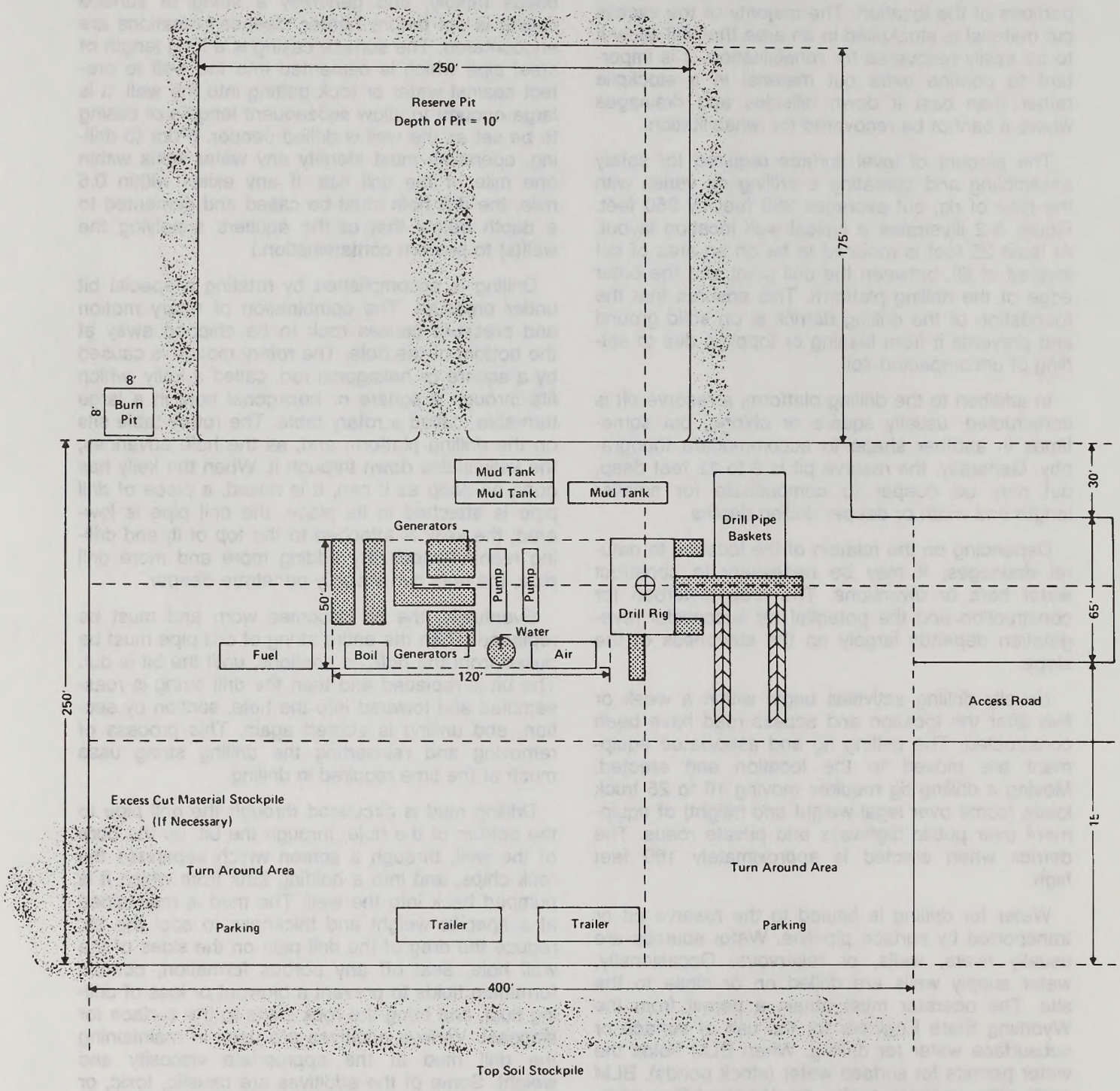


Figure A-2
LOCATION LAYOUT FOR A WELL 9,000 TO 15,000 FEET DEEP

(17,000-20,000 feet) which are becoming more common, may take up to a year to complete. The crews usually work three 8-hour shifts or two 12-hour shifts a day. Pickups and/or cars are used for workers' transportation.

Upon completion of the drilling, the equipment is removed to another location. If oil or gas is not discovered in commercial quantities, the well is a dry hole. The operator is then required to follow state and GS procedures for plugging a dry hole. Rehabilitation of the drill site and access road is in accordance with the stipulations attached to the approval of the well site by the BLM.

Development and Production

Wells are completed and production equipment installed if it is determined that oil or gas is present in commercial quantities. Natural gas of varying qualities is the primary product produced in the assessment area. At present approximately 70 percent of the producing wells in the area are gas, with the remaining 30 percent producing oil. This trend is expected to continue.

Completion calls for the installation of steel casing, which is cemented in, to provide stability and to protect specific underground zones. The casing is perforated into the zone or structure containing the oil or gas. The equipment installed on the casing of a producing well consists of various valves and pressure regulators which are used to control the oil or gas flow to production facilities.

On producing gas wells, if the gas at the wellhead is pipeline quality; that is it does not contain water, dissolved solids, or liquid hydrocarbons in unacceptable amounts, then a minimum of processing equipment is necessary. As the quality of the gas decreases, the amount of processing equipment increases. When water or liquid hydrocarbons are present in the gas they are removed before the gas is mixed with other gas, usually at the wellhead itself. Separators are used to accomplish this. If only water is present, the separator is fairly small and requires only occasional maintenance. If liquid hydrocarbons are present, the separator is larger and more complex, and storage facilities (tank batteries) are required for the liquids until they accumulate in sufficient quantities to be hauled out by large trucks.

Oil wells can be completed as flowing (those wells with sufficient underground pressure to raise the oil to the surface) or if the pressure is inadequate, they are completed with the installation of pumps, usually pumpjacks. Pumpjacks come in a variety of sizes, the larger ones reaching a height of 30 to 40 feet. Pumps are powered by internal combustion engines or electric motors. Fuel for the engines may be casinghead gas or propane.

On producing oil wells if the oil contains water, it is separated before the oil is stored in a tank battery. The fluid is pumped or flows from the wellhead to a heater-treater through pipelines. Heater-treaters are of two types, horizontal and vertical. The maximum height of the former is 8 feet and of the latter is 28 feet. Selection of one type of heater-treater over another is based on space available at the location and/or company preference. Heat is applied to the heater-treater by the firebox (an integral part of the equipment) to break down the emulsion. The heat is supplemented in most cases by chemicals. The oil is then pumped via pipeline to storage tanks, called the tank battery.

Wyoming law prohibits the flaring or venting of natural gas. Exceptions allowed by the Wyoming Oil and Gas Commission are (1) during testing of a new well or (2) when the amount of gas produced with the oil is so small that pipeline construction is not practical. Otherwise, if a well produces both oil and gas, provisions for shipping the gas must be made before oil production can continue.

Gas which occurs with the oil is separated by venting it out the top of the tank battery and into feeder lines leading to transportation lines. If enough casinghead gas is separated to make it economical for marketing, a plant may be constructed to process the gas, or a pipeline may be constructed to carry the product to an existing plant. If the volume of casinghead gas is insufficient to warrant treatment in a gas plant, it is usually used as fuel for pump engines in the field or as heating fuel for the heater-treaters. Gas is flared or vented into the atmosphere if it exceeds the fuel requirements on the lease but is not of commercial quantities.

Oil is then transported to a refinery or to a truck depot where it is unloaded into a pipeline leading to a large interstate pipeline. Trucks that transport the crude oil are large tank trucks, either semi- or truck and trailer.

The production equipment (heater-treater, holding facility for production water (if any is present), and tank battery) are either placed on a portion of the location (on cut rather than fill) or located a short distance from the wellhead along the access road. Production facilities are usually painted black, silver, or with company colors, unless otherwise specified. The heater-treater and tanks are surrounded by earthen dikes to contain accidental spills. Either all the facilities may be fenced, or only the production water pit may be fenced.

Field Development

The most important factor in further development of an oil or gas field is the quantity of production. Other considerations are whether the field is on a lease basis or unitized, the probability of profitable production, the availability of drilling equipment, the necessity to protect a known geologic structure (KGS) from drainage by off-lease drilling, and the degree to which limits of the field are known.

When an oil or gas discovery is made, the Wyoming State Oil and Gas Conservation Commission assigns well spacing for the field. A well spacing pattern must be established before development drilling begins. Factors considered in the establishment of a spacing pattern include data from the discovery well concerning: porosity, permeability, pressure, composition, and depth of formations in the reservoir; well production rates and type (barrels of oil or cubic feet of gas); and the economic effect of the proposed spacing on recovery. The minimum spacing for oil production on federal leases is 40 acres. Spacing for oil wells usually varies from 80 to 320 acres per well. Spacing for gas wells is from 320 to 640 acres per well. Spacing requirements can pose problems in selecting an environmentally sound location. Reservoir characteristics and the drive mechanism determine the most efficient spacing to achieve maximum production. If an operator determines that different spacing is necessary to achieve maximum recovery, the state and federal agencies may grant exceptions to the spacing requirements. Exceptions may also be obtained if the terrain is unsuitable, provided no geologic or legal problems are encountered. The procedures for obtaining approval to drill and for the drilling of development wells are generally the same as those for wildcat (exploration) wells.

As more wells are placed in production, roads are improved by regular maintenance, surfacing with gravel or scoria, and installing drainage crossings. Mineral materials are usually purchased from local contractors and obtained from federal sources. Materials that are obtained from areas of federally owned minerals require a sales contract and are processed through the resource area where the materials occur.

Production from several wells on one lease may be carried by pipeline to a central tank battery. Use of a central tank battery depends on whether or not the oil is from the same formation, and whether or not the partners or stockholders are the same. If commercial quantities of gas are produced with the oil, feeder lines are constructed to carry it to transportation lines.

Surface use in an oil or gas field may be affected by unitization of the leaseholds. In areas of federally owned minerals, an exploratory unit is formed before a wildcat exploratory well is drilled. The boundary of the unit is based on geologic data. The developers of the unit can enter into an agreement to develop and operate as a unit, without regard to separate lease ownerships. Costs and benefits are allocated according to agreed terms.

Development in a unitized field may proceed more slowly than in a field composed of individual leases; in the former case, all owners within the participating area share in any well's production but in the latter, each lessee must drill his own well to obtain production.

Unitization reduces the surface use requirements because all wells are operated as though on a single lease. Duplication of field processing facilities is minimized, because development and operations are planned and conducted by a single operator. Often powerlines are distributed throughout the unit and engines are converted to electric motor. Unitization may also involve wider spacing than usual, resulting in fewer wells. Access roads are usually shorter and better organized.

Many fields go through several development stages. A field may be considered fully developed and produce for several years, and then a well may be drilled to a deeper pay zone. Discovery of a new pay zone in an existing field is called a pool discovery, as distinguished from a new field discovery. A pool discovery may lead to the drilling of additional wells. Existing wells may also be drilled deeper.

A new stage of field development can lead to changes in locations of roads and facilities. All new construction, reconstruction, or alteration of existing facilities—including roads, dams, pits, flowlines, pipelines, tank batteries, or other production facilities—must be approved by GS with surface protection input from BLM before work can commence.

As the productive life of a field progresses, problems arise such as erosion; unvegetated areas; washing out of drainage crossings and roads; plugging of culverts; deterioration of cattleguards; accumulation of derelict equipment; construction of unnecessary roads; unauthorized off-road cross-country travel; and improperly or unrehabilitated pipelines. The BLM prepares rehabilitation plans to correct these problems and to return the field surface area to its original productivity. By adequately taking corrective action as problems arise, total rehabilitation can be accomplished within an acceptable time period after a field is completely exhausted.

Secondary Recovery

Oil cannot be produced unless forces within the petroleum reservoir are great enough to drive the oil to the well bore. Primary production occurs when energy in the reservoir is sufficient to move the oil to the well. When energy sources within the formation are inadequate, secondary production methods are used, involving liquid or gas injection.

Presently in the area, two oil fields are using some form of secondary recovery. Deregulation of oil prices may make additional secondary recovery projects feasible.

On the average, successful water flooding doubles recovery of the resource. The water used in water flooding is usually obtained by drilling a water well in the water flood area or reinjecting water that is recovered with the oil. Very little fresh water is used because it may form chemical bonds with the clays in some reservoir rocks and reduce the permeability of the reservoir formation. Chemicals may be added to the water to aid in releasing any oil that may cling to the reservoir rocks.

As a rule, the producing oil wells on the outer edges of a formation are converted to injection wells. As the need arises, injection wells are drilled or newly drilled oil wells that are not productive are used for the water flooding if they are in the proper location. Liquid or gas that is injected into the formation to aid in secondary recovery is carried to the injection wells by buried pipeline.

Water Disposal

Excess water produced with the oil or as a result of water flooding must be disposed of. Although most produced waters are brackish to highly saline, some are fresh enough for beneficial use. The fresh water is discharged into drainages and is eventually mixed with surface water. Surface owners and public land grazing lessees may obtain fresh water that is discharged from oil fields and use it for agricultural purposes. Water discharge must meet standards of, and be permitted by, the Wyoming Department of Environmental Quality. To aid in the purification of the water, oil skimmer pits are often established between the separating facilities and the surface discharge point.

Low quality water is normally disposed of underground, usually by introduction into a formation containing water of equal or poorer quality. In some fields, dry holes or depleted producing wells are used as disposal wells. Occasionally, new wells are drilled for disposal purposes. In the area, there are two water disposal systems.

Natural Gas Processing and Transmission Facilities

Natural gas as produced at the wellhead is rarely pure methane. It is usually found in combination with other gases. Some of these gases present no problem other than diluting the heating value (BTU output) of the gas. Others can render it unsafe or unsuitable for use as fuel. Whatever the impurities, they must be removed in order to meet established standards for sale and interstate transmission of gas. This requires the construction and operation of processing facilities. There are five operating gas plants in the area. Table A-1 shows common impurities found in wellhead gas and the problems presented.

The most widely publicized impurity is hydrogen sulfide (H_2S). The presence of H_2S makes gas "sour" and potentially dangerous to human life and property. Thus the most widely publicized and discussed gas processing activity is "sweetening." The Whitney Canyon-Carter Creek Final Environmental Assessment (WY-042-EA80-15) contains a detailed discussion of the design, operation, and probable impacts of two such plants. It also addresses some of the more common related problems (e.g., storage and transportation of byproducts).

Formation pressure of the gas varies. Depending on this pressure, various numbers of compressor facilities will be necessary. In areas of high pressure, compressor facilities may not be required until the gas is delivered into main transmission lines. In low pressure fields, compressors may be required in the field or even at smaller groups of wells. Compressor stations range from small structures visited only occasionally by maintenance personnel to large complexes manned by crews on a 24-hour basis.

Transmission Pipelines

Gathering pipelines collect oil and gas from diverse sources within an oil and gas field and then converge into a transmission pipeline or truck line that transports the product to a refinery or other major collection point. From there, distribution pipelines deliver to individual consumers.

A pipeline system includes the pipe, pump and compressor stations, and electrical and communication systems. All these facilities lie within the right-of-way, which is usually 50-feet wide except for pump and compressor stations, which occupy approximately four acres each. Pump stations are

Table A-1

NATURAL GAS IMPURITIES

Compound	Maximum Tolerance	Range of % When Encountered	Purifying Process	Byproducts	Impacts
Hydrogen Sulfide (H_2S)	480 parts per million (.048%)	0.02-32.2%	Claus	Sulfur	Hydrogen (outstack) Waste Water
Carbon Dioxide (CO_2)	None (inert)[1/]	0.2-88.85%	Selexol-absorption and Rectisol-desorption.	Carbon Dioxide	--
Nitrogen (N_2)	None (inert)[1/]	0.7-20.6%	Cryogenic-liquefaction and distillation, separate N_2 + He from Methane.	Nitrogen	--
Helium (He)	None (inert)[1/]	0.09-0.72%	Cryogenic-separate He from N_2.	Helium	--

[1/] The Wyoming PSC requires average standard heating value in pipelines to be at least 1,000 Btus at 60°F.

needed about every 30 miles and compressor stations every 185 miles.

The area actually needed for pipeline construction varies with the diameter of the pipe; but averages 25 feet in width. Typical pipeline construction procedures are shown in Figure A-3. Construction equipment used includes a cat, ditching machine, side boom, backhoe, taping machine, welding trucks, and various hand tools. Usually a 12-foot width of the right-of-way is leveled by removing a minimum amount of topsoil. The topsoil is stockpiled for use in rehabilitation. An additional area of about 10 feet is bladed to allow passage of trucks, weeders, and wrapping machines. In areas where it is relatively flat and there is no danger of fire hazard, there is no clearing done. Draws are spanned to prevent erosion problems. The ditching machine makes a cut two feet wide and three to four feet deep. The steel pipe is welded, doped, taped, lowered into the ditch, and backfilled with 30 inches of dirt. All pipe is treated to prevent corrosion, and if breaks occur it is usually due to mishandling. Topsoil is redistributed and seeded.

All construction, maintenance, and operation of pipelines is performed in accordance with the minimum Federal Safety Standards for Liquid Pipeline, Part 195, Title 40, *Code of Federal Regulations*; appropriate BLM standard stipulations; and special stipulations determined necessary at the time of the field inspection.

Electric Transmission Lines

Transmission lines considered in this environmental assessment are relatively small lines (69 kv and less) on single wood poles in narrow rights-of-way. Average span lengths for single-pole wood structures are 250 to 400 feet. Average span lengths occur only where the ground profile is relatively level. Crossing a rounded ridge may require several structures, while a sharp ridge may only require one. Long spans are needed to cross deep draws and valleys.

The right-of-way width required for electric transmission lines is basically determined by mechanical and electrical clearances but may involve considerations for electromagnetic and electrostatic effects such as audible noise, inductive voltage, and radio and television interference. Right-of-way widths in the area are usually 50 feet or less, and the term of grant is 30 years, with right of renewal.

Equipment required for construction of a powerline includes: a truck with a post-hole digger mounted on it, a flatbed truck which carries the reels of wire, a truck to carry the poles, and pickups. Problem sections of a powerline are sometimes built with the use of hand held augers or helicopters. Surface disturbance results from drilling the holes and from vehicle travel. All disturbed areas are reseeded and no road building is allowed. Conductor wires are shot across drainages to prevent soil disturbance. Pole construction specifications are designed to prevent raptor electrocution.

Appropriate standard right-of-way stipulations, and any special stipulations determined necessary at the time of the field inspection, are attached to the right-of-way grant.

Communication Lines

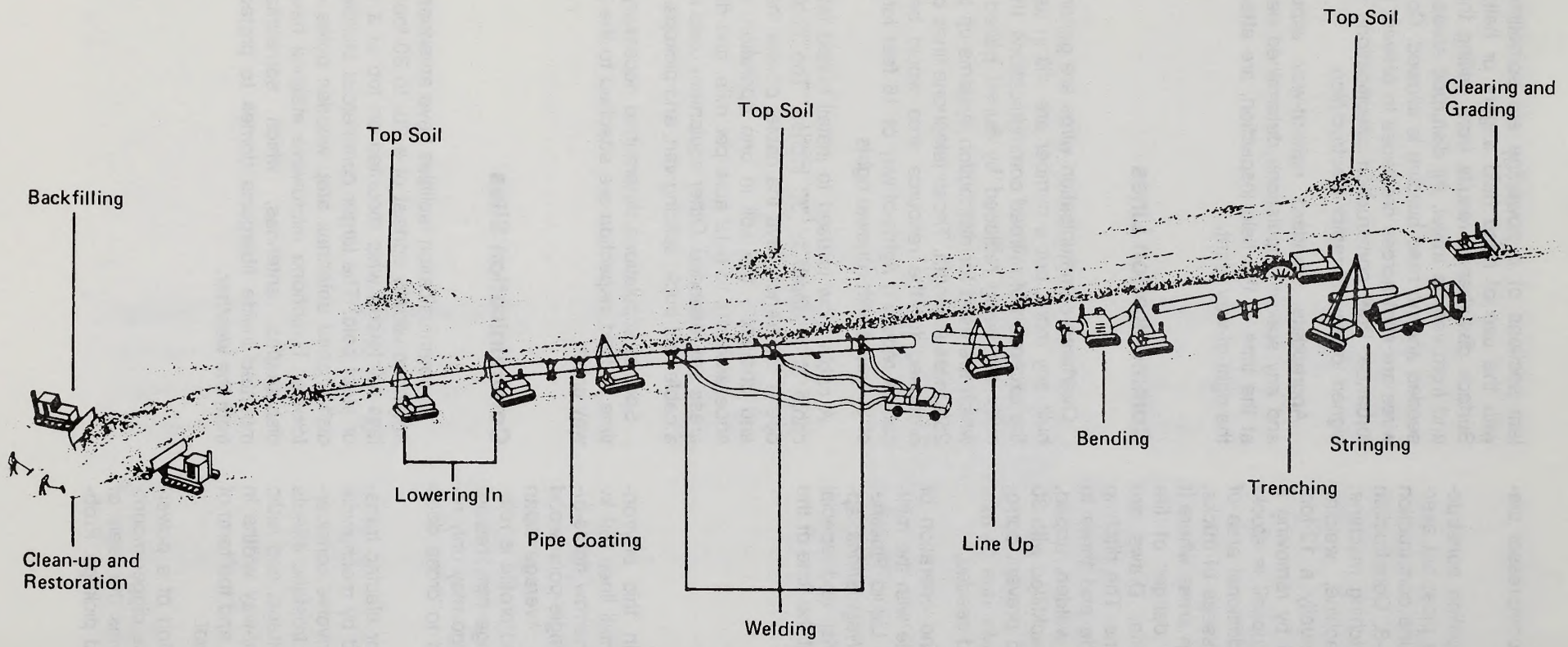
Overhead communication wires are generally not built any more, but a number are still in use. With the exception of railroad communications, these circuits are being replaced by buried paired cables which are used for distribution systems up to about 250 miles in length. Those telephone lines currently proposed for the resource area would be buried cables requiring rights-of-way of 16 feet for a term of 30 years with renewal rights.

A cable plow is used to install buried telephone cable at a depth of 30 inches. The cable plow opens the trench, lays the cable, covers the cable, and compacts the soil in one operation. Disturbance amounts to 0.12 acre per mile, and disturbed areas are reseeded. Other equipment used includes a cable reel truck, splicing van, and pickups.

Special stipulations determined necessary at the time of field inspection are attached to the right-of-way grant.

Communication Sites

All communication facilities have antennas. Radio antennas usually consist of a 20- to 30-foot fiberglass reinforced whip mounted on top of a wooden or steel pole. The larger commercial facilities have dish-shaped antennas atop wooden poles or steel towers. Telephone microwave stations have large dish-shaped antennas, which sometimes are mounted inside fiberglass domes to protect them from the weather.



(Scale Condensed for Illustration Purposes)
The Aerospace Corporation 1975

Figure A-3
TYPICAL PIPELINE CONSTRUCTION SPREAD

ABANDONMENT AND REHABILITATION

The depletion of a field is a gradual progression. Outlying wells are abandoned and the field gets progressively smaller until the total original field is abandoned. Roads that are not necessary for efficient management of the land are obliterated and rehabilitated. Surface pipelines and powerlines are removed. Buried pipelines are left in place.

At times, the abandonment of a single producing well is the same as the abandonment of a field. (In the area, there are occasions when a single well makes up the total field.) Presently, each well is considered as an individual when abandoned and no field is abandoned as a unit.

Abandonment of a once-productive well and a dry hole is similar. When the decision is made to dry hole a well or to take it out of production, a concrete plug is installed at the bottom of the casing, the casing is filled with heavy mud, and a concrete cap is installed on top of the plugged drill pipe, extending four feet aboveground and giving the legal description. However, Wyoming BLM prefers that wells be capped at the ground surface and that no dryhole marker be installed. Usually, one truck can haul enough concrete to plug an abandoned well.

If a once-productive well is being abandoned, the pumpjack, storage tanks, sheds, and anchors are removed. The concrete pad (to which the pumpjack was attached) is usually buried.

Upon abandonment, a well useful as a water producer may be acquired by the surface owner from the oil or gas operator. In this case, the well is plugged below the water-bearing formation and then completed as a water well.

Complete rehabilitation of the drill site is governed by the length of time it takes for the reserve or production pit to dry. The drying time depends on the soil texture and the amount of water remaining in the pit. Pits constructed in porous materials may be dry in less than one month, while those constructed in clay may require as long as one or two years to become dry enough to backfill. Drying time can be accelerated by several methods including the utilization of evaporation aids or pumping the pit dry.

If water in the reserve pit is of suitable quality, and if surface disposal is approved by the Wyoming DEQ, the fluid may be drained onto adjacent vegetation or into a natural drainage. DEQ considers the following factors before allowing surface discharge: results of a complete chemical analysis of the fluid, the proposed discharge quantity and location, and the landowner's preference. If the water quality is too poor for surface disposal, the reserve pit contents can be pumped out and trucked to an appropriate disposal site. These methods enable early rehabilitation of well sites and should be encouraged.

The location is reshaped to approximately the original contour. This requires moving the soil material back to its original position and redistributing the topsoil. Equipment used for rehabilitating the location and access road includes dozers (track-mounted and rubber-tired), scrapers, and motor graders.

BLM presently requires that topsoil be evenly distributed over the site, and the seedbed prepared by disking to a depth of four to six inches, following the contour. Waterbars or terraces are constructed on the reshaped location to prevent erosion. Reseeding can be initiated as soon as the location is recontoured (either partially or completely).

The success of vegetative recovery depends on site-specific seed mixtures and rehabilitation techniques. Recommended seed mixtures for the assessment area are shown in Appendix E. The mixtures were derived from consideration of geographic conditions, elevation, precipitation, and soil type.

BLM currently limits seeding to the periods of September or October and April or May. In addition to seeding in the spring or fall, every effort should be made to seed reasonably soon after seedbed preparation. If left unseeded for one growing season, the site may be occupied by noxious weeds.

The destruction of seedlings by livestock interferes with successful rehabilitation. Seed mixtures in the past were basically developed for the production of livestock forage, consisting mostly of grasses. Livestock concentrate their grazing on such seeded areas and ignore adjacent available native forage. Fencing rehabilitated sites may be required to prevent grazing. The fencing of access road and pipelines is not practical because of their length and problems caused by a fence bisecting the range. Fencing problem sites on steep slopes or in sandy areas is a possibility, depending on the specific situation.

Access roads are reshaped and reseeded in a manner similar to that employed in reclaiming well locations, unless a private landowner requests they be left in place.

Compliance inspections are periodically conducted by BLM to check the progress of the rehabilitation. Final abandonment is not approved until vegetation has been reestablished to the satisfaction of the BLM and GS. On privately owned surface, the landowner must be consulted concerning his satis-

faction with the rehabilitated areas. Performance bonds are required in order to guarantee rehabilitation.

APPENDIX B

UNIT RESOURCE ANALYSIS SUMMARY

INTRODUCTION

In the text that follows, the Unit Resource Analysis (URA), Steps 2 and 3, for both the Salt Wells and Big Sandy resource areas are summarized. Due to differences in data bases, resource characteristics, management priorities, etc., small variations between the two URAs exist. Because of this, the summaries have been generalized, and a few of the elements described may not appear in both of the resource areas' URAs. Tables B-1 and B-2 list the URA overlays.

URA STEP II

.31 Air Resources

This section is divided into two general categories: climate and air quality. The climate section includes such topics as temperature, moisture, wind, and solar radiation. The air quality portion deals with standards, present status, and site specific information on the air in the assessment area.

Also included in this section are a series of tables and figures depicting temperature, precipitation, wind, and air quality information.

.32 Topography

This section serves to divide the area into 20 units. These units are generally divided by physiographic features with the exception of a few units, whose boundaries are delineated by highways or district fences.

The effects of topography on resource management are also discussed. General descriptions of the topographic units are included, with maps.

.33 Geology and Soils

This section is divided into two areas: geology and soils. The geology portion is comprised of descriptions of stratigraphy (general geology) and structure. The soils portion serves to divide the area into units (Overlays: BSRA-S2-.33B1 and SWRA-S2-.33B) based on general soil differences. It should be noted that although these units reflect general soil differences, in many cases specific soil types occur in two or more of the units. Also included is a description of the soil associations found in the area.

.34 Vegetation

The majority of this section describes the plant community types found in the area. Also included are chapters dealing with poisonous plants, threatened plants, noxious weeds, and the effects of plants on management. Finally, tables are present which list the acres of vegetation, growth stages, poisonous species, and fire/plant relationships.

.35 Water Resources

This section mainly deals with water quantity and quality. Both subjects are further divided into the two general categories of water: surface and ground waters.

Also included in this section are a series of tables, figures, and attachments depicting both general and specific hydrological information.

.36 Animals

This section gives a general narrative of the major animal species found in the area. In addition, there are tables which list most of the area's animal species, and their frequency of occurrence.

.37 Fire

This section deals with general fire behavior/potential within the area, and the BLM's plans and projections for suppression.

Table B-1

URA STEP II OVERLAYS

Subject	Title of Overlay	BSRA #	SWRA #
Air Resources	Air Quality and Temperature Isotherms	S2-.31A	
	Precipitation Zones and Estimated Average Snow Depths	S2-.31B	
Geology & Soils	Geology	S2-.33A	S2-.33A
	Physical Profile-Soil Map	S2-.33B1	S2-.33B
	Boundary Locator for Topographic Maps and SCS Detailed Soil Surveys	S2-.33B2	S2-.33C
Vegetation	Vegetation	S2-.34A	S2-.34A
	Threatened Plants and Noxious Weeds	S2-.34B	
Water Resources	Surface Water Resources	S2-.35A1	S2-.35A
	Ground Water Resources	S2-.35A2	S2-.35B
	Water Developments	S2-.35A3	S2-.35C
	Hydrologic Unit Map	S2-.35A4	S2-.35D
	Water Well Interests in Oil and Gas Exploration	S2-.35A5	
Fire	Fire Behavior	S2-.37A	S2-.37B
	Fire Occurrence/Location 1964-68	S2-.37B1	S2-.37A
	Fire Occurrence/Location 1969-75	S2-.37B2	S2-.37A
	Fire Occurrence/Location 1976-79	S2-.37B3	S2-.37A
	Resource Values at Risk	S2-.37C	S2-.37C
Limiting Physical Factors	Limiting Physical Factors	S2-.38C	S2-.38A
	Vegetal-Soil Factors	S2-.38A	
	Erosion Susceptibility Classes	S2-.38B	
Development, Facilities, and Services	Land Treatments and Management Facilities	S2-.39A	S3-.44C
	Access	S2-.39B	S2-.39A
	Cadastral Survey	S2-.39C	S2-.39B
	Index to Aerial Photos	S2-.39D	S2-.39C

Table B-2

URA STEP III OVERLAYS

Subject	Title of Overlay	BSRA #	SWRA #
Lands	Present Land Uses	S3-.41A1	S3-.41A
	Oil and Gas Pipeline Rights-of-Way	S3-.41A2	S3-.41B
	Rights-of-Way Other than Oil and Gas	S3-.41A3	S3-.41C
	Zoning and Classifications	S3-.41A4	S3-.41D
	Withdrawals and Acquired Lands	S3-.41A5	S3-.41E
Minerals	Mineral Classifications and Withdrawals	S3-.42A1	
	Mineral Inventory for Coal Areas to be Assessed for Unsuitability	S3-.42A2	S3-.42D
	Mineral Resource Inventory and Mineral Leasing Overlay for Oil and Gas/Oil Shale	S3-.42A3	
	Mineral Resource Inventory and Mineral Leasing Overlay for Trona/Coal	S3-.42A4	
	Mineral Status Overlay/Mineral Inventory Overlay for Salable Locatable Minerals	S3-.42A5	S3-.42E
	Oil and Gas and Trona		S3-.42A
	Coal and Oil Shale		S3-.42B
	Mineral Inventory for Coal		S3-.42C
Forest Products	Forest Products, Present Situation	S3-.43A	S3-.43A
Range Management	Grazing Administration	S3-.44A3	S3-.44A
	Condition and Trend-Sheep	S3-.44A1	
	Condition and Trend-Cattle	S3-.44A2	
	Horse Inventory-1971 & 76	S3-.44A4a	
	Horse Inventory-1972, 74, & 75	S3-.44A4b	
	Horse Inventory-Summer 1975	S3-.44A4c	
	Horse Inventory-1976, 77, & 78	S3-.44A4d	
	Horse Inventory-1979-80	S3-.44A4e	S3-.44B
	Suitability Determination	S3-.44A5	S3-.44D
	Land Treatment and Management Facilities		S3-.44C
Watershed	Watershed Boundaries	S3-.45A1	
	Erosion Condition and Trend	S3-.45A2	S3-.45A
	Sediment Yield	S3-.45A3	S3-.45B
	Water Quality-Soil Salinity	S3-.45A4	S3-.45C
	Water Quality Point and Nonpoint Sources	S3-.45A5	S3-.45D
	Flood Plains Associated with Coal Reserves	S3-.45A6	S3-.45E

Table B-2
(continued)

Subject	Title of Overlay	BSRA #	SWRA #
Wildlife Habitat	Habitat Management Units/Habitat Studies	S3-.46A1	
	Antelope Distribution	S3-.46A1a	S3-.46A
	Mule Deer Distribution	S3-.46A1b	S3-.46B
	Seasonal Moose and Elk Distribution	S3-.46A1c	S3-.46C
	Large Predators	S3-.46A1d	
	Upland Game Bird Distribution	S3-.46A1e	S3-.46I
	Waterfowl and Aquatic Furbearers	S3-.46A1f	
	Prairie Dog Habitat and Concentration Area	S3-.46A1g	S3-.46F
	Raptor Habitat	S3-.46A1h	S3-.46H
	Raptor Nest Locations	S3-.45A1i	S3-.46G
	Standing Waters	S3-.45A2c	S3-.46E
	Stream Channel Stability Rating Stability Improvement Potential	S3-.46A2a	S3-.46L
	Fish/Reptiles/Amphibians	S3-.46A2b	
	Fisheries Distribution		S3-.46J
	Fisheries Habitat		S3-.46K
	Wyoming Game and Fish Management Units		S3-.46D
Recreation	Cultural-Natural History	S3-.47A1	
	Visual Resource Management	S3-.47A2	
	Wilderness-Rivers and Trails	S3-.47A3	S3-.47E
	Other Recreation	S3-.47A5	
	Other Cultural/Geological/ Zoological/Fishing/Water Sports		S3-.47A
	Off-Road Vehicles/Historical/ Archeological/Management Areas		S3-.47B
	Scenic Quality/Cultural Modification		S3-.47C
	Botanical/Recreation Sites/ Hunting/Winter Sports/ Collecting (Rocks and Minerals)		S3-.47D
	Visual Resource Management		S3-.47F

.38 Limiting Physical Factors

This section identifies general categories of limiting physical factors, such as: vegetal soil factors, erosion susceptibility, limiting factors for development, and other limiting factors. The last category (Other Limiting Factors) serves as a catch-all for many factors such as earthquake faultlines, flood areas, hazardous areas, noise pollution areas, etc.

Also included in this section are tables of erosion susceptibility, and soils with piping potential.

.39 Development, Facilities, and Services

This section is divided into four categories and contains the following information:

A. *Land Treatment and Management Facilities* describes general improvement projects with major BLM management practices and/or maintenance responsibility.

B. *Access* describes road systems, airstrips, and railroads.

C. *Cadastral Survey* describes current conditions and deficiencies that exist.

D. *Aerial Photo Coverage* gives the history of aerial photos in the area, and describes the latest set of photos.

Also included in this section are tables and figures depicting access systems, a facilities inventory (range, wildlife, and recreation), and the Rock Springs District radio net.

URA STEP III

.41 Lands

This section deals with current land use and status within the area. Data are quantified, where possible. The section is divided into nine parts, including:

1. *Land Ownership* gives historical background and current ownership of the land in the area.

2. *Current Intensive Land Use* describes settlement areas, mineral developments, agricultural areas, public purpose areas, utility/transportation systems, and communication sites.

3. *Planning and Land Use Controls* describes land use plans and controls at the state, county, and city levels.

4. *Land Classification* describes both retention and disposal classifications.

5. *Land Withdrawals* describes the different types of land withdrawals, and gives case specific withdrawals wherever possible.

6. *Permits and Leases* states BLM policy with regard to temporary use permits and leases.

7. *Unauthorized Use* lists specific areas of possible trespass.

8. *Water Needs* describes the major water uses, without quantification.

9. *Fire Management* describes fire's impact on the lands activity program.

Figures and tables are also included in this section, specifying lands information.

.42 Minerals

This section deals with current knowledge regarding mineral reserves. An introduction is provided, which defines terms used to categorize the quality and quantity of the various mineral deposits. The different minerals are then classified as either leasable, salable, or locatable, and data are quantified for those minerals with regard to the area.

Figures and tables are also present, showing various information which relates to mineral development.

.43 Forest Products

The objectives of this section are to show the location, quantity, and condition of the area's existing forest product resources. The presence, value, and use of other vegetative resources (Christmas trees, cacti, cones, etc.) are also covered. Summary information is included for those products which are measured in, or convertible to, cubic or board feet, such as logs, pulpwood, posts, and poles.

Finally, tables are present illustrating timber types and values.

.44 Range Management

This section is devoted to describing the existing range conditions in the area. The grazing administration for both domestic livestock and wild, free-roaming horses is covered. Also included are discussions of vegetal composition and suitability,

range condition and trend, water developments, and fire/range relationships.

Finally, tables and figures are included to illustrate the aforementioned discussions.

.45 Watershed

This section serves to describe the current situation with regard to water. Watershed areas and characteristics are identified, as well as water availability, water rights, and water quality. Also included are discussions regarding erosion condition and trend, flood and sediment damages, and watershed response to management activities. Finally, a situation summary discusses hydrological problems and data gaps.

Tables complete the watershed section by illustrating the aforementioned discussions.

.46 Wildlife Habitat

This section deals with the wildlife habitat, as it exists today. Habitat is discussed, as it relates to the various animals occupying the area. A major portion of the section is devoted to terrestrial species. Populations of these animals are covered, as they relate to habitat use/maintenance. Aquatic species and habitat are also covered, including standing waters and stream surveys. Wildlife (both habitat and population) condition and trend are discussed briefly.

Finally, tables and figures are included, illustrating various information relating to wildlife habitat and populations.

.47 Recreation

This section deals with current knowledge and present management of areas with recreational value. An introduction is provided which serves to define the categories of use for the recreation resources. The resources are then classified as either a cultural, visual, off-road vehicle, rivers and trails, natural history, or wilderness resource. The final category entitled "Other Recreation" serves as a catch-all for such uses as rockhounding and water sports.

Finally, tables and figures are present which serve to specify and quantify information regarding recreation.

APPENDIX C

EXISTING PRACTICES

This section identifies those mitigation practices currently in use by BLM in administering oil and gas activity within the Big Sandy and Salt Wells resource areas. Other than the lease stipulations, the majority of BLM's standard mitigation measures are listed on the oil and gas authorization forms and are selected by BLM as appropriate.

OIL AND GAS LEASE STIPULATIONS

The following lease stipulations were developed in cooperation with Geological Survey. Proposed additions or changes are reviewed periodically.

1. All of the land in this lease is included in (recreation or special area, ACEC, etc.). Therefore, no occupancy or disturbance of the surface of the land described in this lease is authorized. The lessee, however, may exploit the oil and gas resources in this lease by directional drilling from sites outside this lease. If a proposed drilling site lies on land administered by the Bureau of Land Management, a permit for use of the site must be obtained from the BLM District Manager before drilling or other development begins.

2. No access or work trail or road, earth cut or fill, structure or other improvement, other than an active drilling rig, will be permitted if it can be viewed from the___(road, lake, river, etc., i.e., Flaming Gorge, Fontenelle Reservoir, etc.).

3. No occupancy or other activity on the surface of___(legal subdivision) is allowed under this lease.

4. No occupancy or other surface disturbance will be allowed within___(660 feet for live-water streams; 1,320 from major recreational waters, i.e., Flaming Gorge, Fontenelle Reservoir, Big Sandy and Eden Reservoirs, Jim Bridger Surge Pond; 1/4 mile either side of original trail remnants, or within the visible horizon, whichever is least) feet of the (road, trail, river, creek, canal, etc.). This distance may be modified when specifically approved in writing by the District Engineer, Geological Survey, with the concurrence of the District Manager, Bureau of Land Management.

5. No drilling or storage facilities will be allowed within___(500) feet of___(live water, the reservoir, etc.) located in___(legal subdivision). This distance may be modified when specifically approved in writing by the District Engineer, Geological Survey, with the concurrence of the District Manager, Bureau of Land Management.

6. No occupancy or other surface disturbance will be allowed on slopes in excess of 25 percent, without written permission from the District Engineer, Geological Survey, with the concurrence of the District Manager, Bureau of Land Management.

7. In order to___(minimize watershed damage, protect important seasonal wildlife habitat, etc.) exploration, drilling, and other development activity will be allowed only during the period from___to ___(Watershed—May 15 to March 1; Wildlife Big Game Range—April 1 to December 15; Wildlife Raptor Habitat July 1 to March 1; Wildlife Sage Grouse Strutting Grounds—May 15 to March 1). This limitation does not apply to maintenance and operation of producing wells. Exceptions to this limitation in any year may be specifically authorized in writing by the District Engineer, Geological Survey, with the concurrence of the District Manager, Bureau of Land Management. (This stipulation has been modified for Sage Grouse Strutting Grounds and Elk Calving Grounds; see Appendix D, Stipulations 24 and 25.)

8. In order to minimize watershed damage during muddy and/or wet periods, the District Manager, Bureau of Land Management, through the District Engineer, Geological Survey, may prohibit exploration drilling or other development. This limitation does not apply to maintenance and operation of producing wells.

9. The___(trail/road) will not be used as an access road for activities on this lease.

10. To maintain aesthetic values, all semipermanent and permanent facilities may require painting or camouflage to blend with the natural surroundings. The paint selection or method of camouflage will be subject to approval by the District Engineer, Geological Survey, with the concurrence of the District Manager, Bureau of Land Management.

11. Wilderness roadless areas, see Figure C-1 (Form 3100-79).

Department of Interior
Bureau of Land Management

WILDERNESS PROTECTION STIPULATION

By accepting this lease, the lessee acknowledges that the lands contained in this lease are being inventoried or evaluated for their wilderness potential by the Bureau of Land Management (BLM) under section 603 of the Federal Land Policy and Management Act of 1976, 90 Stat. 2743 (43 USC Sec. 1782):

Exploration or production activities which are not in conformity with section 603 may never be permitted. Expenditures in leases on which exploration drilling or production are not allowed will create no additional rights in the lease, and such leases will expire in accordance with law.

Activities will be permitted under the lease so long as BLM determines they will not impair wilderness suitability. This will be the case either until the BLM wilderness inventory process has resulted in a final wilderness inventory decision that an area lacks wilderness characteristics, or in the case of a wilderness study area until Congress has decided not to designate the lands included within this lease as wilderness. Activities will be considered nonimpairing if the BLM determines that they meet each of the following three criteria:

(a) It is temporary. This means that the use or activity may continue until the time when it must be terminated in order to meet the reclamation requirement of paragraphs (b) and (c) below. A temporary use that creates no new surface disturbance may continue unless Congress designates the area as wilderness, so long as it can easily and immediately be terminated at that time, if necessary to management of the area as wilderness.

(b) Any temporary impacts caused by the activity must, at a minimum, be capable of being reclaimed to a condition of being substantially unnoticeable in the wilderness study area (or inventory unit) as a whole by the time the Secretary of the Interior is scheduled to send his recommendations on that area to the President, and the operator will be required to reclaim the impacts to that standard by that date. If the wilderness study is postponed, the reclamation deadline will be extended accordingly. If the wilderness study is accelerated, the reclamation deadline will not be changed. A full schedule of wilderness studies will be developed by the Department upon completion of the intensive wilderness inventory. In the meantime, in areas not yet scheduled for wilderness study, the reclamation will be scheduled for completion within 4 years after approval of the activity. (Obviously, if and when the Interim Management Policy ceases to apply to an inventory unit dropped from wilderness review following a final wilderness inventory decision of the BLM State Director, the reclamation deadline previously specified will cease to apply.) The Secretary's schedule for transmitting his recommendations to the President will not be changed as a result of any unexpected inability to complete the reclamation by the specified date, and such inability will not constrain the Secretary's recommendation with respect to the area's suitability or nonsuitability for preservation as wilderness.

FIGURE C-1

WY 3100-79(May 1980)
Page 1 of 2

The reclamation will, to the extent practicable, be done while the activity is in progress. Reclamation will include the complete recontouring of all cuts and fills to blend with the natural topography, the replacement of topsoil, and the restoration of plant cover at least to the point where natural succession is occurring. Plant cover will be restored by means of reseeding or replanting, using species previously occurring in the area. If necessary, irrigation will be required. The reclamation schedule will be based on conservative assumptions with regard to growing conditions, so as to ensure that the reclamation will be complete, and the impacts will be substantially unnoticeable in the area as a whole, by the time the Secretary is scheduled to send his recommendations to the President. ("Substantially unnoticeable" is defined in Appendix F of the Interim Management Policy and Guidelines for Lands under Wilderness Review.)

(c) When the activity is terminated, and after any needed reclamation is complete, the area's wilderness values must not have been degraded so far, compared with the area's values for other purposes, as to significantly constrain the Secretary's recommendation with respect to the area's suitability or nonsuitability for preservation as wilderness. The wilderness values to be considered are those mentioned in section 2(c) of the Wilderness Act, including naturalness, outstanding opportunities for solitude or for primitive and unconfined recreation, and ecological, geological or other features of scientific, educational, scenic, or historical value. If all or any part of the area included within the leasehold estate is formally designated by Congress as wilderness, exploration and development operations taking place or to take place on that part of the lease will remain subject to the requirements of this stipulation, except as modified by the Act of Congress designating the land as wilderness. If Congress does not specify in such act how existing leases like this one will be managed, then the provisions of the Wilderness Act of 1964 will apply, as implemented by rules and regulations promulgated by the Department of the Interior.

DATE _____ SIGNATURE _____

FIGURE C-1 (Continued)

OIL AND GAS AUTHORIZATION FORMS

The following forms are used by BLM in authorizing oil and gas activities. Figures C-2 and C-3 describe the general surface management requirements for mineral leasing. Figures C-4 through C-8 pertain to geophysical exploration.

Form 3040–4
(November 1970)

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

MINERAL LEASING STIPULATIONS

SURFACE MANAGEMENT REQUIREMENTS
FOR EXPLORATION, MINING, AND RECLAMATION

Stipulations may be selected from the following list for inclusion in permits or leases. Care must be exercised to assure that any stipulation used apply specifically to the need for such stipulation. Other stipulations may be drafted as needed to meet specific problems.

1. Activities employing wheeled or tracked vehicles shall be conducted in accordance with industry practices and in such a manner as to minimize surface damage.

2. Trail widths shall be kept to the minimum necessary and may not exceed feet. Surface may be cleared of timber, stumps, and snags. Care must be taken to avoid scarring or removal of ground vegetative cover.

3. Drainage systems shall not be blocked. No cuts or fills shall be made near or in streams which will result in siltation or accumulation of debris. All damage to streams must be repaired to the satisfaction of the authorized officer.

4. All operations must be conducted so as not to change the character or cause pollution of streams, lakes, ponds, waterholes, seeps, and marshes or cause damage to fish and wildlife resources.

5. Surface damage which causes soil movement and/or water pollution must be corrected to the satisfaction of the authorized officer.

6. Vegetation must not be disturbed within 300 feet of any waters designated in a (prospecting permit) (lease) (contract) *except* at authorized stream crossings.

7. No explosives may be used without prior written consent of the authorized officer.

8. Trails and campsites must be kept clean. All garbage and foreign debris must be eliminated by removal or burial. Burning is permissible only by prior written consent of the authorized officer.

9. Existing roads and trails shall be used whenever possible.

10. All survey monuments, witness corners, reference monuments, and bearing trees must be protected against destruction, obliteration, or damage. Any damaged or obliterated markers must be reestablished in accordance with accepted survey practices at expense of (permittee) (contractor) (lessee).

11. The operator shall make every effort to prevent, control, or suppress any fire in the operating area. Reports of uncontrolled fires must be immediately sent to the authorized officer or his representatives.

12. Fill all holes, pits, and excavations to the extent agreed in the approved mining plan and grade to the natural contour.

13. When surface operations are conducted, overburden or other waste shall be returned to the excavation, as set forth in the mining plan and except in instances when the district manager or state director determines that it would be desirable to use an excavation for the permanent impoundment of water or for other beneficial uses.

14. Disposal sites shall be selected and prepared so as to avoid downward percolation of pollutants into aquifers.

15. Disposal systems for solid and liquid wastes shall be designed and constructed so as to avoid landslides, control wind and water erosion, and establish conditions conducive to vegetative growth in the disposal area.

16. Casual accumulations of water on waste piles shall be avoided, and, where necessary, surface waters shall be directed around the piles.

17. Final grading of backfilled and other unconsolidated materials shall be so performed as to present a surface susceptible to vegetation or desired land form.

18. Excavations used for the permanent impoundment of water shall be graded to establish safe access to water for persons, livestock, and wildlife.

19. No solid rock face or bench face shall exceed feet in height. Appropriate access suitable for persons, lifestock, and wildlife shall be provided for every feet of continuous rock or bench face.

20. Except for solid rock faces, bench faces, and excavations used for impoundment of water, those surface areas of the leased premises disturbed by operations conducted by the lessee shall be revegetated when their use is no longer required by the operator. *(Species, methods, and season of seeding or planting, etc. should be specified. These requirements should be practical and generally should not require vegetative rehabilitation beyond level of production.)*

21. Backfilling, final grading, and vegetation shall be completed within two (2) years after the completion or termination of the particular operation involved unless the district manager extends the time.

FIGURE C-2

22. Drill holes shall be permanently sealed or filled as directed by the district manager upon completion of operations.

23. Surface buildings, supporting facilities, and other structures which are not required for particular operations shall be removed and the area graded and revegetated.

24. All operations shall be conducted with a view to avoidance of range and forest fires and spontaneous combustion. Open burning of carbonaceous materials shall be in accordance with suitable practices for fire prevention and control.

25. The lease or contract premises shall be appropriately posted and fenced or otherwise protected to minimize injury to persons, livestock, and wildlife.

26. All access, haul, and other support roads and trails shall be constructed and maintained in such a manner as to control and minimize channeling and other erosion. Roads and trails shall be constructed only at locations approved by the authorized officer.

27. All roads constructed in the operation shall be closed by barricades or protected from erosion by placing of water control bars as required by the district manager.

28. All existing improvements including, but not limited to, fences, gates, cattle guards, roads, trails, culverts, pipelines, bridges, public land survey monuments, and water development and control structures shall be maintained in serviceable condition. Damaged or destroyed improvements shall be replaced, restored, or appropriately compensated for.

29. When agreed by lessee and lessor, the lease site shall be available for other public uses including, but not limited to, livestock, grazing, hunting, fishing, camping, hiking, and picnicking.

30. Topsoil shall be removed and stockpiled prior to removal of overburden. Stockpiles shall be located so as not to be covered by spoil materials and to facilitate their use in final backfilling and grading.

GPO 831-559

FIGURE C-2 (Continued)

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

SURFACE DISTURBANCE STIPULATIONS

Area Oil and Gas Supervisor or
District Engineer *(Address, include zip code)*

Management Agency *(name)*	Address *(include zip code)*

1. Notwithstanding any provision of this lease to the contrary, any drilling, construction, or other operation on the leased lands that will disturb the surface thereof or otherwise affect the environment, hereinafter called "surface disturbing operation," conducted by lessee shall be subject, as set forth in this stipulation, to prior approval of such operation by the Area Oil and Gas Supervisor in consultation with appropriate surface management agency and to such reasonable conditions, not inconsistent with the purposes for which this lease is issued, as the Supervisor may require to protect the surface of the leased lands and the environment.

2. Prior to entry upon the land or the disturbance of the surface thereof for drilling or other purposes, lessee shall submit for approval two (2) copies of a map and explanation of the nature of the anticipated activity and surface disturbance to the District Engineer or Area Oil and Gas Supervisor, as appropriate, and will also furnish the appropriate surface management agency named above, with a copy of such map and explanation.

An environmental analysis will be made by the Geological Survey in consultation with the appropriate surface management agency for the purpose of assuring proper protection of the surface, the natural resources, the environment, existing improvements, and for assuring timely reclamation of disturbed lands.

3. Upon completion of said environmental analysis, the District Engineer or Area Oil and Gas Supervisor, as appropriate, shall notify lessee of the conditions, if any, to which the proposed surface disturbing operations will be subject.

Said conditions may relate to any of the following:

(a) Location of drilling or other exploratory or developmental operations or the manner in which they are to be conducted;

(b) Types of vehicles that may be used and areas in which they may be used; and

(c) Manner or location in which improvements such as roads, buildings, pipelines, or other improvements are to be constructed.

FIGURE C-3

Form 3109-5 (August 1973)

Form 3040–1
(November 1970)
(formerly 3107–1)

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

NOTICE OF INTENT TO CONDUCT OIL AND GAS EXPLORATION OPERATIONS

Name	Address *(include zip code)*

hereby files this "Notice of Intent to Conduct Oil and Gas Exploration Operations" across and upon *(give description of lands by township(s) and range)*

The type of operation to be pursued is ☐ magnetometer ☐ seismograph ☐ other *(specify)*

Approximate date of commencement of operations Upon completion of work, the Bureau of Land Management District Manager shall be furnished a "Notice of Completion of Oil and Gas Exploration Operations."

The undersigned agrees that oil and gas exploration operations will be conducted pursuant to the following terms and conditions:

1. Exploration operations shall be conducted in compliance with all Federal, State and County laws, ordinances or regulations which are applicable to the area of operations including, but not limited to, those pertaining to fire, sanitation, conservation, water pollution, fish and game. All operations hereunder shall be conducted in a prudent manner.
2. Due care will be exercised in protecting lands in this notice. All necessary precautions shall be taken to avoid any damage other than normal wear and tear, to gates, bridges, roads, culverts, cattle guards, fences, dams, dykes, vegetative cover and improvements, and stock watering and other facilities.
3. Appropriate procedures shall be taken to protect any shafts, pits or tunnels, and shot holes shall be capped when not in use to protect the lives, safety, or property of other persons or of wildlife and livestock.
4. All vehicles shall be operated at a reasonable rate of speed, and due care must be taken to safeguard all livestock and wildlife in the vicinity of his operations. Bulldozers shall not be used without advance notification to the District Manager. Existing roads and trails shall be uaed wherever possible; if new roads and trails are made, care should be taken to follow natural contours of the lands where feasible and reatoration and/or reseeding, as requested by District Manager shall be made.
5. Upon expiration, revocation or abandonment of operations conducted pursuant to this "Notice," all equipment shall be removed from the land and the land shall be restored as nearly as practicable to its original condition by such measures as the District Manager may specify. All geophysical holes must be safely plugged. Upon leaving the land, the District Manager shall be informed.
6. Upon request, the location and depth of water sands encountered shall be discloaed to the District Manager.
7. The party conducting such operations shall contact the District Manager prior to actual entry upon the land in order to be appriaed of the practices which should be followed or avoided in the conduct of his operationa in order to minimize damages to property of the United States.

(Signature)	(Signature of Geophysical Operator)
(Address including zip code)	(Address including zip code)

GPO 859 - 935

FIGURE C-4

DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

Case Serial No. _____

PRACTICES TO BE FOLLOWED
DURING GEOPHYSICAL EXPLORATION
OPERATIONS ON NATIONAL RESOURCE
LANDS IN WYOMING

_____
Name, Address, and Telephone Number of Company Filing the Notice of Intent

_____
Seismic Company Party Chief, Name and Telephone Number

_____
Subcontracting Company

1. The operator will furnish a map with the "Notice of Intent" showing approximate line to be used. A map shall also be filed with the "Notice of Completion" showing the completed line. The map should be of a minimum scale of 1/2 inch equals 1 mile.
2. No blading or other dirt work will be allowed without written permission (Permit for Use of Earthmoving Equipment During Geophysical Exploration Operations on National Resource Lands in Wyoming, Form WY-3045-4) from the District Manager.
3. All disturbed areas will be reseeded as directed by the District Manager. Adequate vegetative cover will be established. Adequate cover will be determined through soil testing, vegetative density guides, etc.
4. Rehabilitation of disturbed areas is to be done concurrent with the geophysical operations insofar as possible. Seeding shall be done during the months of September or October. Although chances of failure are much greater with spring seeding, it may be done during April or May if approved hy the District Manager.
5. No trees will be removed or damaged without specific approval from the District Manager. All merchantahle timber shall be purchased by the operator at the total appraised price that is determined by the BLM.
6. Blasting or vibrating within 1/4 mile of federally owned or controlled springs and flowing water wells must he approved in writing by the District Manager.
7. No blasting or dozing will be permitted within 1/4 mile of historic trails, natural areas, identified archeological sites, and recreation areas. The operator shall, unless otherwise relieved by the District Manager:
   a. Engage the services of a qualified professional archeologist to perform and submit a report of an intensive cultural resource inventory on areas where "surface disturbances will likely occur" in connection with the use of earthmoving equipment.
   b. Avoid or mitigate impacts to cultural resources located by the survey.
   c. Undertake additional measures requested by the District Manager to protect cultural resources that may he affected as a result of the operation.
8. The operator shall avoid any operations when the ground is muddy and/or wet. The District Manager may prohibit exploration, drilling, or other activities during wet or heavy snow periods.
9. Water for drilling purposes will not be ohtained from federally owned or controlled water sources such as reservoirs and springs unless specific permission is obtained from the District Manager.
10. Report any available information concerning water sands or artesian flows to the District Office.
11. Sealing, plugging, and capping of drill holes will conform to the requirements of Wyoming Statutes 35-11-404, 1977. Drill hole cuttings will be scattered so that the pile is less then 1 inch in height. (See sample drawings 49-94-3045-1, 2, and 3.)
12. Powder magazines will be located out of sight of and at least 1/4 mile from traveled roads. Loaded shot holes will not be left unattended.
13. All trash, flagging, lath, etc., will be removed and hauled to an authorized disposal site. No oil or lubricants shall be drained onto the ground surface.
14. The operator must notify the District Manager the date rehabilitation operations commence and are completed.
15. Whenever possible, a portable mud pit shall he used when drilling with fluids.
16. A copy of these practices to be followed will be kept by each seismic crew.
17. The operator shall extinguish without expense to the Government all fires on or in the vicinity of the project set or caused by his employees whether set directly or indirectly as a result of operations.

I have been apprised of the practices which should be followed or avoided in the conduct of our geophysical operations. These practices will be explained to all of our subcontractors and they also will be expected to meet all the requirements.

_____ _____
Signature of Party Chief Date

Additional Surface Protection Requirements:

WY-3045-1 (May 1981)

FIGURE C-5

DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

OPERATOR'S RESPONSIBILITIES

The Federal Regulations (43 CFR 3045) for oil and gas exploration operations require cooperation between the District Manager, his staff, and geophysical operators. We have listed below, for the operator's use and review, the requirements and responsibilities defined in the current laws and in the Notice of Intent.

1. The operator is required to file a Notice of Intent to Conduct Oil and Gas Exploration Operations. The notice must include maps showing the location of the line and all necessary access before operations begin. The map should be of a minimum scale of 1/2 inch equals one mile.

2. The operator must be bonded.

3. The operator shall notify the District Manager before he enters onto national resource lands.

4. The operator shall obtain the District Manager's written approval for bulldozer or other dirt work. (Permit for Use of Earthmoving Equipment During Geophysical Exploration Operations on National Resource Lands in Wyoming, Form WY 3045-4.)

5. The operator shall notify the District Manager in writing of any changes in the original notice and secure written approval for the changes before proceeding.

6. The operator is required to comply with the instructions and orders given by the District Manager at the prework conference and during field investigations.

7. The operator shall notify the District Manager that their operations are completed, and they are leaving the land listed on the notice.

8. The operator is required to file a Notice of Completion. This notice must include a minimum scale map showing the actual geophysical exploration line as completed.

9. Under responsibility of State law the operator is reminded to contact private surface owners for permission to enter their lands.

10. The operator's activities must not conflict with or damage the interests and property of other parties on or adjacent to the Federal land on which he is working.

FIGURE C-6 WY 3045-3 (May 1981)

DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

Case Serial No._____
Line I.D. Number(s)_____

PERMIT FOR USE OF EARTHMOVING EQUIPMENT DURING GEOPHYSICAL EXPLORATION OPERATIONS ON NATIONAL RESOURCE LANDS IN WYOMING

_____
Name, Address, and Telephone Number of Company Filing the Notice of Intent

_____
Seismic Company, Party Chief, Name, and Telephone Number

_____ _____
Sub-Contracting Company Equipment Operator's Name

Location:_____

Permission is hereby granted for the following use(s) of the earthmoving equipment:

____ Snow removal provided that the blade is kept at least six (6) inches above the soil surface.

____ Trail breaking for other vehicles without use of the blade.

____ Construction of ford-type crossings on drainages which cannot otherwise be crossed, only if there are no usable fords present in the area. The top 4-6" of surface soil material will be stockpiled on both sides of the crossing and replaced on the surface at the time of rehabilitation. Where feasible, all cuts will be made to the bottom of the creek bed. (Provide operator with "Typical Dry Creek Drainage Crossing" drawing.)

____ Other (Be specific)

This permit expires (estimated time of completion)on _____

I hereby agree to conduct operations only as permitted above.

_____ _____
Equipment Operator Party Chief

_____ _____
District Manager's Representative Date

(Complete this form in duplicate)

FIGURE C-7 WY-3045-4 (Jan 1977)

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

NOTICE OF COMPLETION OF OIL AND GAS EXPLORATION OPERATIONS

Name	Address *(include zip code)*

Pursuant to the notice heretofore filed to conduct oil and gas exploration operations, this is to advise that such operations were completed on , on the lands described in the previous notice.

(Signature)	(Geophysical Operator)
(Address including zip code)	(Address including zip code)

GPO 849-518

Form 3045-2 (January 1973) (formerly 4107-2)

FIGURE C-8

APPENDIX D

NEW MITIGATION MEASURES

This section identifies those reasonably possible mitigation measures which could be applied to eliminate or reduce adverse impacts.

AIR QUALITY

1. The operator will use dust abatement measures on all access roads passing within ___ feet of any subdivision or ranch dwelling if traffic from the exploration and development activities produces enough dust to be visible from the dwelling. Dust from any drilling pad within ___ feet of a residence will be controlled by watering. Topsoil stockpiles will be covered with mulch, netting, or canvas to reduce dust and soil loss. (The city, county, or private landowner should be contacted for their recommendations prior to authorizing the well, right-of-way, etc.)

MINERAL RESOURCES

2. This stipulation should be applied to oil and gas leases issued on lands wholly or partly covered by a preference right lease application or a federal coal lease for which an approved mining and reclamation plan does not exist. "This lease is subject to (coal lease or PRLA number). Stipulations addressed to simultaneous operations will be attached at the time of approval of the APD. Plans for oil field development and proposed secondary recovery will be made in cooperation with GS and the lease holder."

3. To avoid a trespass situation resulting from unauthorized removal of materials for road surfacing, any APDs which do not specify a materials source should have an information statement added which states "A sales contract for scoria and/or sand and gravel is required prior to the removal of these materials from an area of federally owned minerals."

TOPOGRAPHY

4. During reclamation of the site, the operator will push fill material back into the cuts and up over the backslope to approximate the original topography. No depressions will be left that will trap excessive amounts of water or form persistent ponds. (This measure should be attached to all APDs requiring a cut of more than three feet to level the platform.)

5. The operator will reshape abandoned access roads by pushing the fill material back into the cuts.

6. To the extent possible, roads should follow natural contours. Where steep slopes would require extensive cuts and fills, roads should follow ridgelines.

SOILS AND WATER RESOURCES

7. In areas where problem soils are known to exist, reclamation procedures will be followed as specified in Appendix E, Site-Specific Rehabilitation Plan.

8. The operator will not push soil material and overburden over sideslopes or into drainages. All soil material disturbed will be placed in an area where it can be retrieved.

9. If there is snow on the ground when construction begins, the operator will remove it before the soil is disturbed, and pile it downhill from the location of the topsoil stockpile.

10. The operator will place the reserve pit for any drilling location constructed on a slope of 25% or more on the side of the location next to the backslope (only when not in conflict with hydrogen sulfide safety requirements) or place 50% of the pit in the cut. Topsoil will be stockpiled on either end of the location. This measure would eliminate any chance of reserve pit failure and facilitate easier rehabilitation.

11. The reserve pit will be oriented to prevent collection of surface runoff. If possible, the operator will construct a trench on the uphill side of the reserve pit before the drilling rig is installed. If this is infeasible, trench construction must occur immediately after removal of the drilling rig. The trench will

serve to divert surface drainage around the reserve pit and will be left intact until the pit is closed.

VEGETATION

In order to ensure optimum establishment of the most desirable adaptive native species, adhere to site specific revegetation plan as outlined in Appendix E.

13. Surface disturbance must be preceded by an approved reclamation plan. BLM will not release performance bonds for 10 years unless good vegetative cover has sustained itself for two years. Evaluation will be made after the third and fifth growing season. In the case of initial seeding failure, the company will modify the revegetation plan and/or reseed until an acceptable vegetation cover is achieved.

14. Right-of-way clearing prior to beginning construction shall be limited to 30 feet on the extreme right or left of the right-of-way. The portion of the right-of-way utilized for movement of equipment shall, wherever possible, be just scalped of vegetation. Brush beaters will be used whenever possible. If it is necessary to remove soil during right-of-way clearing, graders shall be used so the depth of cut can be better controlled.

The depth of the soil removed will be kept to a minimum. Ripping may be required prior to seeding. Vegetation stripped from an area will be windrowed along the right-of-way, and then put back on the disturbed area after the right-of-way is reseeded.

15. To hasten reestablishment of vegetation, reduce the time soils are exposed to wind and water, and discourage noxious weed invasion, the following measure should be adopted: "All dry holes, abandoned wells, and unused portions of well locations within precipitation zones of 14 inches or less shall be fenced for a period of five growing seasons."

16. The operator may not remove or damage trees without specific approval from the District Manager, BLM. All merchantable timber shall be purchased by the operator at the total appraised price that is determined by BLM.

17. The operator will cover and enclose the burn pit with small mesh wire, to prevent trash from being blown off-site, and to prevent wildfires. Proper precaution will be taken at all times to prevent and suppress fires. The grantee will be held responsible for suppression costs for any fires on public lands caused through negligence of his employees, contractors, or subcontractors. No debris burning will be allowed without specific permission from the District Manager, BLM.

18. After the location has been reshaped and prior to redistributing the topsoil, the operator will rip or scarify the drilling platform on the contour, to a depth of at least 12 inches. The ripped places are to be no farther than 24 inches apart.

19. The operator will distribute the topsoil evenly over the entire location and prepare the seedbed by disking on the contour to a depth of 4 to 6 inches. Prompt redistribution of topsoil (preferably within 9 months of removal) is helpful for revegetation of disturbed areas, since native seed and rootstock can survive only short periods of stockpiling.

20. The operator shall not use pipeline routes for roads without approval of the District Manager, BLM.

WILDLIFE

21. Reserve pits constructed in porous material close to perennial streams or public drinking water sources will be lined with plastic or bentonite clay before they are used.

22. The operator will avoid constructing new roads in or through drainage bottoms, whenever possible. Temporary low water crossings will be used for crossing drainages when feasible. (If the road is to be retained, installation of a culvert may be preferable.) The feasibility of proposed flowing stream crossings will be analyzed by the Division of Operations, BLM. Engineering designs will be submitted by the operator with the APD.

23. No seismic activity will be permitted within two aerial miles of big game concentrations during critical stress periods, which will be determined on a site-specific basis by the resource area biologist.

24. No occupancy or other surface disturbance will be allowed within a 1,320-foot radius of the center of a sage grouse strutting ground (lek). No exceptions to this will be granted. In order to protect the nesting area around the strutting ground, exploration, drilling, and other development activity will be allowed within a 1 3/4-mile distance from the 1/4-mile lek protection zone only during the period June 15 to March 1. Exceptions to the monthly limitations in any year may be specifically authorized in writing by the District Engineer, Geological Survey, with the concurrence of the District Manager, Bureau of Land Management.

25. Special Stipulation No. 7 (see Appendix C) should be modified to include elk calving areas as follows: "In order to protect known elk calving areas; exploration, drilling, and other development activity will be allowed only during the period from June 30 to May 10." This limitation does not apply to maintenance and operation of producing wells.

26. Destruction of prairie dog towns should be avoided as much as possible. All prairie dog towns that will be affected by construction activities must be surveyed for black-footed ferrets. If ferrets are located during these surveys, or at any time during the construction or life of the project, formal consultation with the Fish and Wildlife Service should be initiated immediately.

27. The operator will flag all reserve pits to discourage waterfowl from landing on them.

28. BLM reserves the right to require modification or additions to structures placed on the right-of-way if found to be necessary to ensure the safety of wildlife, including raptors. Such modifications will be made without liability or expense to the United States.

29. When the operation of the engines powering a drilling rig is expected to cause undue stress to (species), mufflers will be installed on the engines.

LIVESTOCK GRAZING

30. If production water meets DEQ requirements and is permitted for surface discharge, and BLM determines that it would be of beneficial use for livestock, and if GS concurs, the water will be transported via pipe or open ditch (concrete or rock lined) to the place it is impounded, enters live water, or enters a drainage. If the water is discharged into a drainage, conditions of slope, soil, and rate of flow must be such to prevent erosion.

31. Range improvements, such as fencing or reservoirs, will not be disturbed by the operator; or where disturbance is necessary, they will be left in the original or better condition as determined by the District Manager, BLM.

32. Drilling or construction will not be conducted in lambing or calving pastures from ___to___(dates) unless authorized by the livestock operator.

CULTURAL RESOURCES

33. Because of the discovery of significant cultural resources the project location should be changed as described below and as indicated on the attached map: _____

34. Because of a high probability of locating buried cultural deposits during construction; the operator will provide an archeologist, approved by the BLM, to monitor disturbing activities at the following location: _____

Construction methods will be used which allow the archeologist to identify buried cultural resources without endangering the personnel monitoring the disturbance. If any potentially significant buried resources are identified, and the archeologist determines that further operations will seriously affect the cultural resource, work will be suspended as required in standard stipulation___(number), and BLM will evaluate the resource and develop additional stipulations as needed. The cost of avoidance or salvage of any cultural resource identified by the archeologist will be that of the operator. A report of all activities of the archeologist will be submitted to BLM within 30 days following completion of the monitoring.

35. In order to provide additional data on National Register eligibility, a detailed evaluation must be made of the following sites:___. The evaluation will be made by an approved archeologist or historian at the operator's expense. Techniques for such evaluation include but are not limited to, detailed mapping, inventory or collection of surface material, and test excavation at prehistoric sites. At historic sites, appropriate measures may also include photo-recording, archival research, and interviews. If subsurface testing is necessary, it will be the minimum amount necessary to determine the subsurface significance of the site. Any C^{14} and thermoluminescent samples collected will be submitted for analysis at an accepted laboratory. Any pollen or flotation samples collected will be analyzed in an acceptable manner. A written report on the results of the investigations will be submitted to BLM within 30 days following completion of field work.

AESTHETICS

Visual Resources

36. To the extent possible, roads should follow natural contours. Where steep slopes would require extensive cuts and fills, roads should follow ridgelines.

37. Powerlines and pipelines will be placed in utility corridors or alongside roads where possible.

Noise

38. Where noise sources (e.g., internal combustion engines) will cause a significant disturbance (e.g., adjacent to residential areas), muffling of engines should be considered.

APPENDIX E

SITE-SPECIFIC REHABILITATION PLAN

It is mandated by NEPA and Wyoming State Law that surface disturbance shall be mitigated by rehabilitating the area with species compatible to predisturbance condition and production levels. These standards are designed to further that goal.

The assessment area contains a wide variety of vegetation communities, soil associations, and microclimates. These factors interact within the area, creating a myriad of ecologically distinct communities which preclude the development of a single strict set of rehabilitation stipulations. All rehabilitation practices in the area should be site specific, taking into account soil structure, soil fertility, soil moisture, erosion potential, and adapted plant species for the area. The following guidelines are to be used in drawing up site-specific rehabilitation plans in conjunction with the standard rehabilitation stipulations such as acceptable recontouring, etc.

1. In regions of high winds; drill pads, roads, and rights-of-way should be ripped at least one foot deep and then seeded instead of preparing a pulverized, mellow seed bed. This will aid in reducing wind erosion and crusting.

2. Studies at this time have not shown a consistent improvement in reclamation success due to fertilizing at the time of seeding. If soil tests indicate fertilizer is necessary or desired, it should be applied after seedling establishment. The fertilizer should be a time release form, the amount and composition of which would be based on the site-specific soil analysis.

3. Seeding should be done from October 15 until the ground freezes and/or between ground thaw and May 15.

4. Where possible, an annual cereal crop should be sown in early spring; this stand would be reseeded with native species during the following fall or spring. The annual cereals are fast and easy to establish, thereby providing fast initial soil stabilization. The plants also help accumulate snow during the winter, creating a microclimate more favorable to revegetation.

5. All drill seeding should be with the contours whenever possible.

6. Any topsoil to be stockpiled for more than one year should be seeded with the same mixture as will be planted when the site is reclaimed. This will maintain a viable seed source in the topsoil, continue the nutrition cycles, and stabilize the stockpile.

7. For locations on northeast, north, northwest, west, and southwest slopes, the operator should erect snow fences perpendicular to the prevailing wind and of a sufficient length and height to drift snow onto rehabilitated locations. Snow fences will be placed after reshaping, construction of erosion-control structures, and reseeding are completed. The fences will be left in place until vegetation has been successfully reestablished. Fencing will increase the moisture available to seedlings and increase the chances of successful revegetation.

8. Seeding should be done with a rangeland drill rather than with an agricultural drill. The rangeland drill covers the seed better and can be pulled over rough terrain such as ripped soils, steep slopes, etc. Where drilling is not possible, seed shall be broadcast and the area shall be raked or chained to cover the seed.

It cannot be emphasized enough that reclamation in this area must be site specific. The area has low precipitation zones; most of the area falls into 7-9 or 10-14 inch zones. It is generally accepted that revegetation in areas receiving under 10 inches of precipitation, is extremely difficult and that any stand establishment will take two to five years without supplemental irrigation. When other adverse conditions are also present, such as shallow soils, high clay content, and an impermeable salt layer within two to three feet of the surface; revegetation becomes even more difficult. These reasons as well as those mentioned previously, make it imperative that all reclamation plans be site specific.

Site-specific reclamation plans should be drawn up at the same time the designs for the project are prepared. This will enable the companies to design the project for the least expensive, easiest rehabilitation, and to identify and rectify critical rehabilitation problems. In designing rehabilitation plans, all available data sources (BLM soil and vegetation inventories, etc.) on the area should be consulted, along with all resource specialists, (i.e., soil scientists, botanists, wildlife biologists, foresters, etc.) knowledgeable of the general southwest Wyoming area. Soil tests should be done prior to designing the reclamation plans in order to maximize the revegetation potential of the area.

The vegetation of the area before disturbance is frequently a good indication of what problems to expect in reclamation; i.e., if there is a layer of alkali close to the surface, the plants will be salt tolerant species such as saltbush or greasewood; if the soil is deeper, the vegetation will be sagebrush or other shrubs or trees which have deep root systems and little salt tolerance. A major problem of the low basins in the area is the high levels of salt. In removing and stockpiling topsoil, the lessee must be careful not to mix in the salt layer to avoid changing the soil chemistry.

The seeding of shrubs poses another problem. The low precipitation zones and the seed physiology of native shrubs, combined with other harsh environmental factors, make it extremely difficult to establish shrubs from seeds. For this reason in areas in which browse is critical for wildlife habitat and forage, it is recommended that containerized shrub stock be planted in the approximate species density represented in the area. However, since some seeds will germinate and survive, shrubs are included in the list of suggested seed species for the various rehabilitation zones and should be used, especially where containerized stock is not planted. Attempts may also be made to transfer shrubs from the area immediately surrounding the disturbed area. It is suggested that in sandy or loamy areas along linear rights-of-way and on small disturbed sites which are not in crucial browse areas for wildlife, that the shrub species be left out of seed mixtures, allowing shrub invasion from the surrounding area.

The assessment area has been divided into six zones based on precipitation, soils, and vegetation: (1) 7-9 inch precipitation, nonalkaline soils; (2) 7-14 inch precipitation, alkaline soils; (3) 10-14 inch precipitation, nonalkaline soils; (4) 10-19 inch precipitation, shallow soils; (5) 15-19 inch precipitation; and (6) wetlands.

The following seed lists (Tables E-1 through E-6) provide guidelines for the development of specific mixtures for disturbed areas in the six rehabilitation zones. The plants listed are native plants which are dominants or co-dominants in the vegetation types within the rehabilitation zone. Mixtures should be determined from a site-specific analysis of vegetation prior to disturbance. It is recommended that each mixture contain a minimum of three grasses, two forbs, and one shrub to ensure stand diversity. Not all of the seed recommended may be available in large quantity, but each species listed is a viable revegetation species for use in this area. On sites where the seed is to be drilled, 12 to 15 pounds of pure live seed should be used. This amount should be doubled for broadcast seeding, steep south and west facing slopes, and on extremely harsh sites such as 7-9 inch alkaline sites. Every effort should be made to protect seedings from damage by livestock, wildlife, or wild horses. Fencing may be necessary. If there is no stand development within two years, the area should be reseeded.

Table E-1

REVEGETATION SPECIES-REHABILITATION ZONE 1

(7-9 Inch Precipitation, Nonalkaline Soils)

sand dropseed	(Sporobolus cryptandrus)
sandberg bluegrass	(Poa sandbergii)
western wheatgrass	(Agropyron smithii)
thickspike wheatgrass	(A. dasystachyum)
squirreltail	(Sitanion hystrix)
Indian ricegrass	(Oryzopsis hymenoides)
penstemon	(Penstemon arenicola, P. strictus)
phlox	(Phlox hoodii)
aster	(Aster glaucodes)
wallflower	(Erysimum asperum)
rabbitbrush	(Chrysothamnus viscidiflorus, C. nauseosus)

Table E-2

REVEGETATION SPECIES-REHABILITATION ZONE 2

(7-14 Inch Precipitation, Alkaline Soils)

western wheatgrass	(Agropyron smithii)
squirreltail	(Sitanion hystrix)
alkali sacaton	(Sporobolus airoides)
Indian ricegrass	(Oryzopsis hymenoides)
sandberg bluegrass	(Poa sandbergii)
onion	(Allium textile)
phlox	(Phlox bryoides)
eriogonum	(Eriogonum brevicaule)
scarlet globemallow	(Sphaeralcea coccinea)
winterfat	(Eurotia lanata)
nuttall's (gardner's) saltbush	(Atriplex nuttallii)

Table E-3

REVEGETATION SPECIES-REHABILITATION ZONE 3

(10-14 Inch Precipitation, Nonalkaline Soils)

thickspike wheatgrass	(Agropyron dasystachyum)
bluebunch wheatgrass	(A. spicatum)
letterman's needlegrass	(Stipa lettermanii)
green needlegrass	(S. viridula)
Indian ricegrass	(Oryzopsis hymenoides)
bluegrass	(Poa canbyii and/or P. sandbergii)
junegrass	(Koeleria nitida same as K. cristata)
umbrella plant	(Eriogonum umbellatum)
lupine	(Lupinus sericeus)
yarrow	(Achillea millefolium)
groundsel	(Senecio integerrimus)
rabbitbrush	(Chrysothamnus viscidiflorus)
currant	(Ribes aureum)
snowberry	(Symphoricarpos oreophilus)

Table E-4

REVEGETATION SPECIES-REHABILITATION ZONE 4

(10-19 Inch Precipitation, Shallow Soils)

bluebunch wheatgrass	(Agropyron spicatum)
thickspike wheatgrass	(A. dasystachyum)
pine grass	(Calamagrostis rubescens)
Indian ricegrass	(Oryzopsis hymenoides)
sandberg bluegrass	(Poa sandbergii)
umbrella plant	(Eriogonum umbellatum)
groundsel	(Senecio integerrimus)
phlox	(Phlox hoodii)
bitterbrush[1/]	(Purshia tridentata)
mountain mahogany[1/]	(Cercocarpus montanus)
martin's buckbrush[1/]	(Ceanothus martinii)

[1/] Shrub establishment may be facilitated by transplanting.

Table E-5

REVEGETATION SPECIES-REHABILITATION ZONE 5

(15-19 Inch Precipitation[1/])

slender wheatgrass	(Agropyron trachycaulum)
mountain brome	(Bromus carinatus)
alpine timothy	(Phleum alpinum)
skyline bluegrass	(Poa epilis)
Canada wildrye	(Elymus canadensis)
sheep fescue	(Festuca ovina)
junegrass	(Koeleria nitida)
Idaho fescue	(Festuca idahoensis)
letterman needlegrass	(Stipa lettermanii)
yarrow	(Achillea millefolium)
western sweet cicely	(Osmorhiza occidentalis)
Colorado columbine	(Aquilegia caerulea)
bluebells	(Mertensia oblongifolia)
lupine	(Lupinus sericeus)
snowberry	(Symphoricarpos oreophilus)
serviceberry	(Amelanchier alnifolia)
snowbrush ceanothus	(Ceanothus velutinus)
bitterbrush	(Purshia tridentata)

[1/] Disturbance in a wooded area will be reclaimed with a seed mixture and transplants of the tree species present in the area.

Table E-6

REVEGETATION SPECIES-REHABILITATION ZONE 6

(Wetlands[1/])

fowl bluegrass	(Poa palustris)
fowl mannagrass	(Glyceria striata)
redtop	(Agrostis alba)
northern reedgrass	(Calamagrostis neglecta)
sand dropseed	(Sporobolus cryptandrus)
thickspike wheatgrass	(Agropyron dasystachyum)
Nebraska sedge	(Carex nebraskensis)
yarrow	(Achillea millefolium)
willows-bare rootstock	(Salix spp.)

[1/] Immediate rehabilitation is imperative for these areas because of erosion problems and because these areas are extremely productive. Therefore it is strongly recommended that the areas be immediately seeded with an annual cereal and interseeded with the above species at a later date.

APPENDIX F

ENVIRONMENTAL ASSESSMENT OF ADOBE TOWN

The information in this appendix was taken from a field environmental assessment of a wildcat gas well and associated field development in the Adobe Town and Monument Valley Units of the Adobe Town Wilderness Study Area. That EA was prepared in March 1981 by Geological Survey (GS) Environmental Specialists Chris Hanson and Bill Bingham, with assistance from BLM resource specialists in developing mitigation. The BLM Rawlins and Rock Springs District Offices concurred with the GS assessment.

Figure F-1 is the EA table of contents, which is an indication of how much of the discussion is presented in this appendix and the entire extent of the EA.

INTRODUCTION

This field Environmental Assessment was prepared under the Geological Survey-Conservation Division's Interim Environmental Assessment procedures. These procedures mandate the categorical exclusion of projects that are within the bounds of the nine (9) environmental criteria of 516DM2.3A. In the event any one or more criteria are exceeded, an environmental assessment is required. An EA was prepared in this instance since two criteria were either exceeded or were in question to a considerable degree. Another reason for preparation of this EA was that two of the proposed wells were likely to become confirmation wells to two discoveries (one in each of two federal oil and gas units—the Adobe Town Unit (approximately 39,602 acres) in the northern part, and the Monument Valley Unit (approximately 24,985 acres) in the southern part). The area of concern is the entire Adobe Town Wilderness Study Area (WSA).

The criteria were:

1. The unique characteristics of the area have led to the Wilderness Study Area designation of approximately 125 square miles (85,710 acres) out of the approximately 178 square miles (114,000 acres) that were originally included within the Wilderness Inventory Unit. An environmental analysis is required since this criterion may be met because the area is a wilderness study area, may become a wilderness area, and the area has unique characteristics which may be adversely affected.

2. Approval of the twelve projects applied for would likely establish a precedent for field development of the WSA area. Since this criterion may be met, an EA is necessary. There are two deep discovery wells in the area. Adobe No. 1 is located in the northern area of the WSA. This project was approved in June 1978, prior to the September 1978 wilderness review that resulted in Adobe Town WSA. The second deep discovery well is less than one mile out of the WSA boundary (Monument Valley No. 1 Well, a re-entry of Twin Fork No. 1). Two of the proposed wells would be confirmation wells to these discoveries, and if within the WSA boundary, may set a precedent for other drilling. The number of wells applied for (12 proposed) are enough, if all are drilled, to be at least preliminary development, and the impact would be cumulative.

RELATED FIELD DEVELOPMENT

The number of wells that would be drilled depends on results of drilling and completion of each prospect. The reservoir characteristics encountered for each producing zone may indicate infill drilling, if more efficient recovery is determined possible. The current spacing is one gas well per 640 acres. The operator estimates well drilling costs will range from $1.5 to 8.0 million per site. A gas processing plant is anticipated if development is determined to be commercially feasible. Other field development may include pipelines, powerlines, pump stations, communication facilities, and re-injection facilities or wells. A gas processing plant may be needed, but the site is unknown at this time.

Initially, one rig is anticipated to be drilling at a time; however, up to four rigs may be drilling at one time. Wells were anticipated to require 120 to 210 days per well to drill, depending upon the target formation. No hydrogen sulfide (H_2S) gas or other noxious gases were anticipated at these well sites at the specified depths. Abnormal temperatures and pressures were expected below 13,000-15,000 feet, depending on which well was drilling.

TABLE OF CONTENTS FOR ADOBE TOWN

FIGURE F-1

SOILS

Due to the instability and general poor quality of soils in the Adobe Town-Monument Valley area, soil types were considered to be the primary limiting factor in field development. This is principally because the native soils are both a poor road base and a poor surfacing material. As a result, soils were used to determine potential road/pipeline utility corridors for the field area as shown in Table F-1.

The soils in the area are fragile and mostly shallow. Most are sandy clay or clay. There are stabilized dunes and a few active dunes. Soils are unstable, contain small amounts of organic material and macronutrients, and are very poorly developed. Many are quickly eroded when slope is greater than 7%.

An Order II Soils Survey for this area is available on 7.5 quadrangles at either the Rock Springs or Rawlins District Offices of the BLM.

Spring runoff of snow melt will result in muddy roads in the area due to high clay content of soils. Roads should be built up, gravel applied, and adequate drainage provided, to minimize the problem.

ALTERNATIVES TO THE PROPOSED ACTION

1. Deny the proposed drill sites. Under lease provisions, the Geological Survey has an obligation to allow mineral development **if** the environmental consequences are not too severe or irreversible. If sites are dry holes, the sites would be, over a 3- to 7-year period, rehabilitated with the effects substantially mitigated, if not totally annulled. If the wells are productive, mitigating measures will be adhered to and the environmental damage held to a minimum. Proposed well sites located in the WSA will follow strict procedures to prevent unnecessary and undue environmental degradation, as well as protect operators' lease rights.

2. Extensive consultation between GS and BLM, indicates that subject well sites can be located without extensive destruction to the environment. In addition, all pre-FLPMA leases are to be considered as valid existing rights. This, coupled with the growing scarcity of oil and gas produced in the United States, indicates that the alternative of not proceeding be rejected.

3. Drilling of these wells should be approved provided all sites adhere to the mitigating measures outlined herein, and specific measures determined at field inspection of each proposed site now or in the future in this area.

MITIGATING MEASURES

1. All proposed well sites will be inspected by GS and BLM prior to approval, to ensure compliance with general mitigating measures, and any measures needed for specific sites.

2. Access roads should be gravelled and built up in many places where water could collect. These would be delineated by soil type (Table F-1).

3. Production facilities will be painted a neutral color (sand-brown) to blend with surroundings.

4. Corridor necessary pipelines, powerlines, and roads (details available in Rock Springs District Office), according to the following restrictions:

Utility and Transportation Corridors

Five utility and transportation corridors would be established. They are: Shell Creek East, Bitter Creek North, Powder Wash South, Monument East, and Circle. (Details are available in Rock Springs District Office). These corridors would be 200 feet in width. Uses allowed and **restricted** to these corridors are:

a. Roads of a width greater than 18-foot crown width.

b. Surface or buried oil, gas, or water lines with a diameter of six inches or more.

c. Overhead electrical distribution lines.

Sites for permanent facilities such as processing plants, storage or maintenance facilities, compressor stations, labor camps, etc., must be contiguous to, but not within, these corridors.

Proposed projects must be centerline staked. Standards for approval and construction will be based upon the soils and topographic conditions encountered on the route.

Uses Allowed Outside of the Corridors

The following uses would be allowed outside the corridors: supplemental exploration, individual well sites, access roads 18 feet or less in crown width, pipelines less than 6 inches in diameter, temporary surface pipelines, and necessary support and production facilities, unless otherwise specified.

Uses proposed outside the corridors will be applied for by conventional procedures (APD, right-of-way, etc.). Proposed projects must be staked. Standards for approval and construction will be

Table F-1

SIGNIFICANT CHARACTERISTICS AND LIMITATIONS OF THE SOILS IN THE ADOBE TOWN WILDERNESS STUDY AREA

X - Limitation for Revegetation
O - Limitation for Construction

Footnote No.	1/	2/	3/	4/	5/	6/	7/	8/	9/	10/	11/	12/	13/	14/
Soil	% of Area	ERD <10"	AWC <3"	pH >9.0	Wind Erodibility	Water Erodibility	Slow Infiltration	Plasticity	Unified Classification	USDA Texture	Range Site	Road Bed Suitability	Clay %	Road Surface Suitability
Kandaly	27		X		X O				SM	Lfs	SA	Fair	2- 6	Fair
Badland	17	X	X		X O	X O	X O	O				Poor		Unsuitable
Westvaco	8		X			X O			CL, GM, GC SC, SM	Clay Loam, Gravelly Loam	SU	Good	18-50	Fair-Good
Youjay	6	X	X	X		X O	X O		CL, SM	Clay Loam	Sh	Poor-Fair	27-40	Poor-Fair
Chrisman	4						X O	O	CL, CH, MH	Clay Loam	Sl	Poor	35-59	Unsuitable
Dines	4				X		X O	O	CL, ML	Silty Clay Loam	SU	Poor-Fair	18-35	Poor-Unsuitable
Huguston	4								SM	Fsl	SSY	Fair	5-18	Fair
Otterson	4		X		X O	X O			SM, SC	Lfs	SY	Fair	2- 6	Poor-Fair
River Wash	4				X O	X O						Unsuitable	2- 6	Unsuitable
Monte	3			X					ML, SM, SC, CL	Clay Loam	SU	Poor-Fair	18-35	Poor-Fair
Sandbranch	3				X O		X O		CL, ML	Clay Loam, Vfsl	SU	Poor-Fair	10-40	Poor-Unsuitable
Winton	3	X	X			X			GM, SM, SC	Channery Sandy Loam	VSh	Good	5-18	Fair-Good
Glenderson	2				X O		X O		ML	Vfsl	SU	Poor	2-10	Unsuitable
Horsley	2	X	X			X O	X O		GM, CL, ML	Scl	Sh	Poor-Fair	18-35	Poor-Fair
LaClede	2								CL	Silt Loam	SU, LY	Fair	18-35	Poor
Pepal	2								SM, SC, GM	Fsl	SY	Fair	5-18	Poor-Fair
Rock Outcrop	2	X	X				X O							
Shell Creek	1		X			X O	X O	O	ML, CL, MH	Silty Clay	SU	Poor	27-40	Unsuitable

Table F-1 (Continued)

Footnote No.	1/	2/	3/	4/	5/	6/	7/	8/	9/	10/	11/	12/	13/	14/
Soil	% of Area	ERD <10"	AWC <3"	pH >9.0	Wind Erodibility	Water Erodibility	Slow Infiltration	Plasticity	Unified Classification	USDA Texture	Range Site	Road Bed Suitability	Clay %	Road Surface Suitability
Tesgulf	1		X		X	O			SM, SC	Fine Sandy Loam	SY	Fair	5-18	Fair
Thayer	1				X	O			SM, ML, SM, SC	Fsi	SU	Fair	5-18	Poor-Fair

1/ Represents the approximate percentage of occurrence of the soil (and associated conditions) in the area.

2/ Effective Rooting Depth less than 10"-Restrictive layers (e.g., bedrock, coarse gravel, impervious clay, etc.) are encountered within 10" of the surface. Severe limitation to revegetation.

3/ Average Waterholding Capacity less than 3"-Because of texture, structure, or other characteristics, a soil moisture deficiency will exist under optimum precipitation conditions.

4/ pH greater than 9-Limitation to revegetation.

5/ Wind Erodibility-Surface soil texture and structure make the unit vulnerable to wind erosion when disturbed.

6/ Water Erodibility-Surface soil texture and structure make the unit vulnerable to water erosion when disturbed.

7/ Slow Infiltration-Internal drainage is slow, resulting in ponding.

8/ Plasticity-A characteristic of certain clays, rendering them unstable when wet and making them difficult to properly compact.

9/ Unified Classification-An engineering classification of soils as to their suitability for construction. This rating, in conjunction with 5/, 6/, 8/, 10/, and 13/ yield the classifications for road construction in 12/ and 14/. GM-Silty gravels, gravel-sand-silt mixtures; GC-Clayey gravels, gravel-sand-clay mixtures; SM-Silty sands, sand-silt mixtures; SC-Clayey sands, sand-clay mixtures; ML-Inorganic silts and very fine sands, rock flour, silty or clayey fine sands or clayey silts with slight plasticity; CL-Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays; MH-Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts; CH- Inorganic clays of high plasticity, fat clays. (From Soils Manual for the Design of Asphalt Pavement Structures, second edition (MS-10), The Asphalt Institute, March 1978).

10/ USDA (Soil Conservation Service) Texture-A universal classification system which identifies the percentages of various soil particle types and sizes in a profile. Fsi-Fine sandy loam; VFsl-Very fine sandy loam; Lfs-Loamy fine sand; Sci-Sandy clay loam.

11/ Range Site-Identifies the potential plant community. Useful in selecting plant species for reclamation. SA-Sands; SU-Saline upland; Sh-Shale; Sl-Saline lowland; SSY-Steep sandy; Sy-Sandy; VSh-Very shallow; Ly-Loamy. For detailed information, see Soil Conservation Service's "Technician Guide to Range Sites and Range Condition With Initial Stocking Rate" for Green River and Great Divide Basins. A description of each range site is available upon request from the BLM Rock Springs District Office.

12/ Road Bed Suitability-An interpretation of the characteristics of the soil relative to road bed construction. As suitability decreases, such things as lift, compaction, slope of shoulder, grade, etc., become more critical and restricted. Where column 9/ contains more than one rating and this rating is expressed as a range, different layers of the soil profile have significantly different construction characteristics which will have to be considered in location and approval of specific projects.

13/ Percent Clay-Percentage of clay encountered in the soil profile.

14/ Road Surface Suitability-See general comments on 12/. Unsuitable means a road must be graveled. Poor or fair may also mean that the road must be graveled, depending on the proposed use of the road and the thickness and distribution of the soil layers.

based on soil and topographic conditions encountered on the site and the legal status of the lease in question.

5. Selection of access roads to mitigate impacts to visual and physical aspects. Limit the number of loops and interconnecting roads in the area. Reclamation should include mulching, especially on the access roads.

SUMMARY OF IMPACTS

Surface scars resulting from construction work, well pad, and the access road would be visible for the lives of the projects and for at least 3-7 years after abandonment. There would be no socioeconomic impact for an individual well, but field development may cause minimal impacts in the Baggs area. Temporary relocation of wildlife would occur, but the degree is unknown. It is noted that populations of wildlife in the area are generally low. Erosion is the primary impact in the area, and dust levels and pollutants would increase somewhat during construction and drilling phases. Vegetation impacts would be low, since vegetation is sparse. Temporary air quality and noise impacts from construction and drilling would occur. Production phase effects on air quality and noise would be minimal in the absence of accidents (spills, etc.). It is noted that natural wind and water erosion in the area are significant, and man-produced impacts for well sites at the current spacing would be small in comparison.

CONTROVERSIAL ISSUES

The Adobe Town-Monument Valley area has long been a point of contention between wilderness groups (i.e., wilderness values) and the mineral industry (i.e., mineral resource values). The controversy existed prior to the designation of the Adobe Town Wilderness Inventory Unit or Wilderness Study Area by the BLM. The potential for hydrocarbons in the area has been known for at least 10 years, but only recently has it become economically feasible to develop tight reservoir sands at depths of 17,000 to 18,000 feet.

BLM direction prior to Judge Kerr's decision indicated that mineral development would be severely inhibited, since it may impair wilderness values, even on leases issued prior to FLPMA (1976). However, Judge Kerr's decision reversed this direction, in that valid leases, regardless of the date of issue, cannot be severely stipulated, after the fact, to the point of restricting the operator from exercising his lease rights.

GLOSSARY

ANIMAL UNIT MONTH (AUM). The forage required to support one cow and calf for one month (1,800 pounds on a 50 percent utilization basis); an AUM also is considered the forage required to support one horse, five sheep, five deer, one elk, one moose, or about 15 pronghorn antelope.

INFILTRATION RATE. The maximum rate at which water can move into a soil.

SOIL HORIZON. A layer of soil or soil material approximately parallel to the land surface and differing from adjacent genetically related layers in physical, chemical, and biological properties or characteristics such as color, structure, texture, consistency, kinds and numbers of organisms present, degree of acidity or alkalinity, etc.

UNIVERSAL SOIL LOSS EQUATION. An equation used to design water erosion control systems: A = RKLSPC wherein A is average annual soil loss in tons per acre per year; R is the rainfall factor; K is the soil erodibility factor; L is the length of slope; S is the percent slope; P is the conservation practice factor; and C is the cropping and management factor. (T = soil loss tolerance value that has been assigned each soil, expressed in tons per acre per year.)

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Map 11-3 — Management Considerations (Vegetation and Reclamation) is being developed and will be available when the final edition of this assessment is published.

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T. 30 N.
T. 29 N.
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T. 26 N.
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T. 20 N.
T. 19 N.

SUBLETTE COUNTY
SWEETWATER COUNTY
LINCOLN COUNTY
SWEETWATER COUNTY
SUBLETTE COUNTY
FREMONT COUNTY

Green River
Big Sandy River
Little Sandy Creek
Dry Sandy Creek
Pacific Creek
Jack Creek
Muddy Creek
Willow Creek
Hay Meadow Reservoir
Big Sandy Reservoir
Eden Reservoir
Fontenelle Reservoir
John Hay Reservoir
North Fork Bear Creek
Bear Creek
Farson
Eden
Blanchard Creek
Landers Creek
Sweetwater River
Fish Creek
Steamboat Mountain
Killpecker Creek
Rock Creek
Black Rock Creek
Thayer Junction
Bitter Creek

SEEDSKADEE NATIONAL WILDLIFE REFUGE

28
187
372
80

Map II-1
POTENTIAL MINERAL CONFLICTS

BIG SANDY – SALT WELLS
OIL AND GAS LEASING
ENVIRONMENTAL ASSESSMENT

☆U.S. GOVERNMENT PRINTING OFFICE 1981 — 576-818

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SUBLETTE COUNTY
SWEETWATER COUNTY

LINCOLN COUNTY
SWEETWATER COUNTY

SUBLETTE COUNTY
FREMONT COUNTY

Fontenelle Reservoir

Big Sandy Reservoir

Eden Reservoir

Hay Meadow Reservoir

John Hay Reservoir

Farson

Eden

Big Sandy River

Pacific Creek

Landers Creek

Sweetwater River

Fish Creek

Jack Morrow Creek

Killpecker Creek

Alkali Creek

Rock Creek

Black Rock Creek

North Bear Creek

Bear Creek

Thayer Junction

SEEDSKADEE NATIONAL WILDLIFE REFUGE

187

28

372

80

Map II-4
MANAGEMENT CONSIDERATIONS
WILDLIFE HABITAT

BIG SANDY – SALT WELLS
OIL AND GAS LEASING
ENVIRONMENTAL ASSESSMENT

U.S. GOVERNMENT PRINTING OFFICE 1981 — 576-619

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T. 30 N.
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T. 24 N.
T. 23 N.
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T. 21 N.
T. 20 N.

SUBLETTE COUNTY
SWEETWATER COUNTY
SUBLETTE COUNTY
FREMONT COUNTY

Green River
Big Sandy River
Little Sandy Creek
Big Sandy Reservoir
Eden Valley
Farson
Eden
Pacific Creek
Dry Sandy Creek
Hay Meadow Reservoir
Bear Creek
John Hay Reservoir
Jack Morrow Creek
Steamboat Mountain
Black Rock Creek
Killpecker Creek
Alkali Creek
Boars Tusk
Fontenelle Reservoir
SEEDSKADEE NATIONAL WILDLIFE REFUGE
Beaver Junction

28
187
372

Potential or Uninventoried Habitat

Active Habitat

Historic Habitat

Scale 1:250,000

5 0 5 10 15 Miles

5 0 5 10 20 Kilometres

SEEDSKADEE NATIONAL WILDLIFE REFUGE

FLAMING GORGE NATIONAL RECREATION AREA

Rock Springs

Bitter Creek

Green River

Uinta County

Sweetwater County

Sweetwater County, Wyoming

Daggett County, Utah

T. 22 N.
T. 21 N.
T. 20 N.
T. 19 N.
T. 18 N.
T. 17 N.
T. 16 N.
T. 15 N.
T. 14 N.
T. 13 N.
T. 12 N.

R.114W. R.113W. R.112W. R.111W. R.110W. R.109W. R.108W. R.107W. R.106W. R.105W. R.103W. R.102W. R.101W. R.100W. R.99W. R.98W. R.97W. R.95W.

Map II-5
MANAGEMENT CONSIDERATIONS
RAPTOR HABITAT
BIG SANDY - SALT WELLS
OIL AND GAS LEASING
ENVIRONMENTAL ASSESSMENT

U.S. GOVERNMENT PRINTING OFFICE 1981 — 576-418